

X. APPENDIX D

EXISTING OSHA STANDARDS RELATED TO LOCKOUT, TAGOUT,
OR THE CONTROL OF ENERGY DURING MAINTENANCE

NOTE: THE INFORMATION IN THIS APPENDIX WAS ADAPTED FROM
INFORMATION SUPPLIED BY OSHA.

General Industry Lockout Related

Standard Provisions

SPECIFICATIONS FOR ACCIDENT PREVENTION SIGNS AND TAGS

<u>No.</u>	<u>STANDARD</u>
1910.145(f)(1)	(i) The tags are a temporary means of warning all concerned of a hazardous condition, defective equipment, radiation hazards, etc. The tags are not to be considered as a complete warning method, but should be used until a positive means can be employed to eliminate the hazard; for example, a "Do not Start" tag on power equipment shall be used for a few moments or a very short time until the switch in the system can be locked out; a "Defective Equipment" tag shall be placed on a damaged ladder and immediate arrangements made for the ladder to be taken out of service and sent to the repair shop.
1910.145(f)(3)	(iii) Do Not Start tags shall be placed in a conspicuous location or shall be placed in such a manner that they effectively block the starting mechanism which would cause hazardous conditions should the equipment be energized.
1910.145(f)(4)	(i) Danger tags should be used only where an immediate hazard exists. There should be no variation in the type of design of tags posted or hung to warn of specific dangers.
1910.145(f)(5)	(i) Caution tags should be used only to warn against potential hazards or to caution against unsafe practices.
1910.145(f)	(6) Out of order tags. Out of Order tags should be used only for the specific purpose of indicating that a piece of equipment, machinery, etc., is out of order and to attempt to use it might present a hazard.

POWERED INDUSTRIAL TRUCKS

1910.178(q)	(4) Trucks in need of repairs to the electrical system shall have the battery disconnected prior to such repairs.
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OVERHEAD AND GANTRY CRANES

1910.179(g)(5)	(i) The power supply to the runway conductors shall be controlled by a switch or circuit breaker located on a fixed structure, accessible from the floor, and arranged to be locked in the open position.
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(ii) On cab-operated cranes a switch or circuit breaker of the enclosed type, with provision for locking in the open position, shall be provided in the leads from the runway conductors. A means of opening this switch or circuit breaker shall be located within easy reach of the operator.

(iii) On floor-operated cranes, a switch or circuit breaker of the enclosed type, with provision for locking in the open position, shall be provided in the leads from runway conductors. This disconnect shall be mounted on the bridge or footwalk near the runway collectors. One of the following types of floor-operated disconnects shall be provided:

1910.179(1)(2)

(i) Before adjustments and repairs are started on a crane the following precautions shall be taken:

(b) All controllers shall be at the off position.

(c) The main or emergency switch shall be open and locked in the open position.

(d) Warning or "out of order" signs shall be placed on the crane, also on the floor beneath or on the hook where visible from the floor.

DERRICKS

1910.181(f)(2)(i)

(c) The main or emergency switch shall be locked in the open position, if an electric hoist is used.

(d) Warning or out of order signs shall be placed on the derrick and hoist.

WOODWORKING MACHINERY REQUIREMENTS

1910.213(a)

(10) It is recommended that each power-driven wood working machine be provided with a disconnect switch that can be locked in the off position.

1910.213(b)

(3) On applications where injury to the operator might result if motors were to restart after power failures, provision shall be made to prevent machines from automatically restarting upon restoration of power.

1910.213(b)

(5) On each machine operated by electric motors, positive means shall be provided for rendering such controls or devices inoperative while repairs or adjustments are being made to the machines they control.

MECHANICAL POWER PRESSES

- 1910.217(b)(8) (i) A main power disconnect switch capable of being locked only in the Off position shall be provided with every power press control system.
- 1910.217(d)(9) (iv) The employer shall provide and enforce the use of safety blocks for use whenever dies are being adjusted or repaired in the press.

FORGING MACHINES

- 1910.218(a)(3) (iii) Means shall be provided for disconnecting the power to the machine and for locking out or rendering cycling controls inoperable.
- (iv) The ram shall be blocked when dies are being changed or other work is being done on the hammer. Blocks or wedges shall be made of material the strength and construction of which should meet or exceed the specifications and dimensions shown in Table O-11.
- 1910.218(d) (2) Shutoff valve. Steam hammers shall be provided with a quick closing emergency valve in the admission pipe line at a convenient location. This valve shall be closed and locked in the off position while the hammer is being adjusted, repaired, or serviced, or when the dies are being changed.
- 1910.218(e)(1) (ii) Air-lift hammers shall have an air shutoff valve as required in paragraph (d)(2) of this section and should be conveniently located and distinctly marked for ease of identification.
- (iii) Air-lift hammers shall be provided with two drain cocks: one on main head cylinder, and one on clamp cylinder.
- 1910.218(f) (1) Mechanical forging presses. When dies are being changed or maintenance is being performed on the press, the following shall be accomplished:
- (i) The power to the press shall be locked out.
- (ii) The flywheel shall be at rest.
- (iii) The ram shall be blocked with a material the strength of which shall meet or exceed the specifications or dimensions shown in Table O-11.
- 1910.218(f) (2) Hydraulic forging presses. When dies are being changed or maintenance is being performed on the press, the following shall be accomplished.

(i) The hydraulic pumps and power apparatus shall be locked out.

(ii) The ram shall be blocked with a material the strength of which shall meet or exceed the specifications or dimensions shown in Table O-11.

1910.218(g) (1) Hot trimming presses. The requirements of paragraph (f)(1) of this section shall also apply to hot trimming presses.

1910.218(h) (2) Lockout. Upsetters shall be provided with a means for locking out the power at its entry point to the machine and rendering its cycling controls inoperable.

(5) Changing dies. When dies are being changed, maintenance performed, or any work done on the machine, the power to the upsetter shall be locked out, and the flywheel shall be at rest.

1910.218(i) (1) Boltheadings. The provisions of paragraph (h) of this section shall apply to boltheadings.

(2) Rivet making. The provisions of paragraph (h) of this section shall apply to rivet making.

1910.218(j) (1) Billet shears. A positive-type lockout device for disconnecting the power to the shear shall be provided.

WELDING, CUTTING, AND BRAZING

1910.252(c)(1) (i) Installation. All equipment shall be installed by a qualified electrician in conformance with subpart S of this part. There shall be a safety-type disconnecting switch or a circuit breaker or circuit interrupter to open each power circuit to the machine, conveniently located at or near the machine, so that the power can be shut off when the machine or its controls are to be serviced.

1910.252(c)(2) (ii) Capacitor welding. Stored energy or capacitor discharge type of resistance welding equipment and control panels involving high voltage (over 550 volts) shall be suitably insulated and protected by complete enclosures, all doors of which shall be provided with suitable interlocks and contacts wired into the control circuit (similar to elevator interlocks). Such interlocks or contacts shall be so designed as to effectively interrupt power and short circuit all capacitors when the door or panel is open. A manually operated switch or suitable positive device shall be installed, in addition to the mechanical interlocks or contacts, as an added safety measure assuring absolute discharge of all capacitors.

PULP, PAPER AND PAPERBOARD MILLS

- 1910.261(b) (4) Lockouts. Devices such as padlocks shall be provided for locking out the source of power at the main disconnect switch. Before any maintenance, inspection, cleaning, adjusting, or servicing of equipment (electrical, mechanical, or other) that requires entrance into or close contact with the machinery or equipment, the main power disconnect switch or valve, or both, controlling its source of power or flow of material, shall be locked out or blocked off with padlock, blank flange, or similar device.
- (5) Vessel entering. Lifelines and safety harness shall be worn by anyone entering closed vessels, tanks, ship bins, and similar equipment, and a person shall be stationed outside in a position to handle the line and to summon assistance in case of emergency. The air in the vessels shall be tested for oxygen deficiency and the presence of both toxic and explosive gases and vapors, before entry into closed vessels, tanks, etc., is permitted. Self-contained air- or oxygen-supply masks shall be readily available in case of emergency. Work shall not be done on equipment under conditions where an injury would result if a valve were unexpectedly opened or closed unless the valve has been locked in a safe position.
- 1910.261(e) (2) Slasher tables. Saws shall be stopped and power switches shall be locked out and tagged whenever it is necessary for any person to be on the slasher table.
- (10) Stops. All control devices shall be locked out and tagged when knives are being changed.
- 1910.261(e)(12) (iii) Whenever it becomes necessary for a workman to go within a drum, the driving mechanism shall be locked and tagged, at the main disconnect switch, in accordance with paragraph (b)(4) of this section.
- 1910.261(e) (13) Intermittent barking drums. In addition to motor switch, clutch, belt shifter, or other power disconnecting device, intermittent barking drums shall be equipped with a device which may be locked to prevent the drum from moving while it is being emptied or filled.
- 1910.261(f)(6) (i) When cleaning, inspection, or other work requires that persons enter rag cookers, all steam and water valves, or other control devices, shall be locked and tagged in the closed or "off" position. Blank flanging of pipelines is acceptable in place of closed and locked valves.

- 1910.261(g)(4) (ii) A man shall be stationed outside to summon assistance if necessary. All intake valves to a tank shall be blanked off or disconnected.
- 1910.261(g)(15) (i) Valves controlling lines leading into a digester shall be locked out and tagged. The keys to the locks shall be in the possession of a person or persons doing the inspecting or making repairs.
- 1910.261(g)(16) (i) Safety regulations governing inspection and repairing of pressure tanks-accumulators (acid) shall be the same as those specified in subparagraph (15) of this paragraph.
- 1910.261(g)(19) (iii) When blow lines from more than one digester lead into one pipe, the cock or valve of the blow line from the tank being inspected or repaired shall be locked or tagged out, or the line shall be disconnected and blocked off.
- 1910.261(g)(21) Inspection and repair of tanks. All piping leading to tanks shall be blanked off or valved and locked or tagged. Any lines to sewers shall be blanked off to protect workers from air contaminants.
- 1910.261(j)(1) (iii) Repairs for cleaning of blockage shall be done only when the shredder is shutdown and control devices locked.
- 1910.261(j)(4) (iii) When cleaning, inspecting, or other work requires that persons enter the beaters, all control devices shall be locked or tagged out, in accordance with paragraph (b)(4) of this section.
- 1910.261(j)(6) (i) All control devices shall be locked or tagged out when persons enter stock chests, in accordance with paragraph (b)(4) of this section.
- 1910.261(j)(5) (iii) When cleaning, inspecting, or other work requires that persons enter pulpers, all steam, water, or other control devices shall be locked or tagged out. Blank flanging and tagging of pipe lines are acceptable in place of closed and locked or tagged valves. Blank flanging of steam and water lines shall be acceptable in place of valve locks.
- 1910.261(k)(2) (ii) All drives shall be provided with lockout devices at the power switch which interrupts the flow of current to the unit.

Textiles

- 1910.262(c) (1) Means of stopping machines. Every textile machine shall be provided with individual mechanical or electrical means for stopping such machines. On machines driven by belts and shafting, a locking-type shifter or an equivalent positive device shall be used. On operations where injury to the operator might result if motors were to restart after failures, provision shall be made to prevent machines from automatically restarting upon restoration of power.
- 1910.262(n) (2) Protection for loom fixer. Provisions shall be made so that every loom fixer can prevent the loom from being started while he is at work on the loom. This may be accomplished by means of a lock, the key to which is retained in the possession of the loom fixer, or by some other effective means to prevent starting the loom.
- 1910.262(p) (1) J-box protection. Each valve controlling the flow of steam, injurious gases, or liquids into a J-box shall be equipped with a chain, lock, and key, so that any worker who enters the J-box can lock the valve and retain the key in his possession. Any other method which will prevent steam, injurious gases, or liquids from entering the J-box while the worker is in it will be acceptable.
- 1910.262(q) (2) Kier valve protection. Each valve controlling the flow of steam, injurious gases, or liquids into a kier shall be equipped with a chain, lock, and key, so that any worker who enters the kier can lock the valve and retain the key in his possession. Any other method which will prevent steam, injurious gases, or liquids from entering the kier while the worker is in it will be acceptable.

BAKERY EQUIPMENT

- 1910.263(k)(12) (i) Where pan cooling towers extend to two or more floors, a lockout switch shall be provided on each floor in order that mechanics working on the tower may positively lock the mechanism against starting. Only one start switch shall be used in the motor control circuit.
- 1910.263(1)(3)(iii) (b) Main shutoff valves shall be locked in the closed position when men must enter the oven or when the oven is not in service.
- 1910.263(1)(8) (iii) A main disconnect switch or circuit breaker shall be provided. This switch or circuit breaker shall be so located that it can be reached quickly and safely.

The main switch or circuit breaker shall have provisions for locking it in the open position if any work on the electrical equipment or inside the oven must be performed.

SAWMILLS

- 1910.265(c)(12) (v) Open switches. Before working on electrical equipment, switches shall be open and shall be tagged, blocked, or locked out.
- 1910.265(c) (13) Hydraulic systems. Means shall be provided to block, chain, or otherwise secure equipment normally supported by hydraulic pressure so as to provide for safe maintenance.
- 1910.265(c)(26) (iii) Blocking hoisting platform. Means shall be provided to positively block the hoisting platform when employees must go beneath the stacker or unstacker hoist.
- (v) Locking main control switches. Main control switches shall be so designed that they can be locked in the open position.
- 1910.265(e)(1) (iv) Carriage control. A positive means shall be provided to prevent unintended movement of the carriage. This may involve a control locking device, a carriage tie-down, or both.
- 1910.268(1) (2) Before the voltage is applied, cable conductors shall be isolated to the extent practicable. Employees shall be warned, by such techniques as briefing and tagging at all affected locations, to stay clear while the voltage is applied.
- 1910.268(m)(7) (i) Prior to grounding a radio transmitting station antenna, the employer shall insure that the rigger in charge: (A) Prepares a danger tag signed with his signature, (B) Requests the transmitting technician to shutdown the transmitter and to ground the antenna with its grounding switch, (C) Is notified by the transmitting technician that the transmitter has been shutdown, and (D) Tags the antenna ground switch personally in the presence of the transmitting technician after the antenna has been grounded by the transmitting technician.

NATIONAL ELECTRICAL CODE

1910.309

NEC Article 430-86(a) 430-86. Motor Not in Sight from Controller. Where a motor and the driven machinery are not in sight from the controller location, the installation shall comply with one of the following conditions:

(a) The controller disconnecting means is capable of being locked in the open position.

GENERAL SAFETY AND HEALTH PROVISIONS

1926.20(b) (3) The use of any machinery, tool, material or equipment which is not in compliance with any applicable requirement of this part is prohibited. Such machine, tool, material, or equipment shall either be identified as unsafe by tagging or locking the controls to render them inoperable or shall be physically removed from its place of operation.

NONIONIZING RADIATION

1926.54 (e) Beam shutters or caps shall be utilized, or the laser turned off, when laser transmission is not actually required. When the laser is left unattended for a substantial period of time, such as during lunch hour, overnight, or at change of shifts, the laser shall be turned off.

FIRE PROTECTION AND PREVENTION

1926.150(d)(1) (ii) During demolition or alterations, existing automatic sprinkler installations shall be retained in service as long as reasonable. The operation of sprinkler control valves shall be permitted only by properly authorized persons. Modification of sprinkler systems to permit alterations or additional demolition should be expedited so that the automatic protection may be returned to service as quickly as possible. Sprinkler control valves shall be checked daily at close of work to ascertain that the protection is in service.

1926.200(h) (1) Accident prevention tags shall be used as a temporary means of warning employees of an existing hazard, such as defective tools, equipment, etc. They shall not be used in place of, or as a substitute for, accident prevention signs.

(2) Specifications for accident prevention tags similar to those in Table G-1 shall apply.

1926.304 (a) All fixed power driven woodworking tools shall be provided with a disconnect switch that can either be locked or tagged in the off position.

WELDING AND CUTTING

1926.352 (g) For the elimination of possible fire in enclosed spaces as a result of gas escaping through leaking or

improperly closed torch valves, the gas supply to the torch shall be positively shut off at some point outside the enclosed space whenever the torch is not to be used or whenever the torch is left unattended for a substantial period of time, such as during the lunch period. Overnight and at the change of shifts, the torch and hose shall be removed from the confined space. Open end fuel gas and oxygen hoses shall be immediately removed from enclosed spaces when they are disconnected from the torch or other gas-consuming device.

ELECTRICAL-GENERAL REQUIREMENTS

- 1926.400(g) (1) Equipment or circuits that are deenergized shall be rendered inoperative and have tags attached at all points where such equipment or circuits can be energized.
- (2) Controls that are to be deactivated during the course of work on energized or deenergized equipment or circuits shall be tagged.
- (3) Tags shall be placed to identify plainly the equipment or circuits being worked on.

BASE-MOUNTED DRUM HOISTS

- 1926.553(a)(3) (i) A device to disconnect all motors from the line upon power failure and not permit any motor to be restarted until the controller handle is brought to the "off" position.
- (iii) A means whereby remotely operated hoists stop when any control is ineffective.

CONVEYORS

- 1926.555(a) (7) Conveyors shall be locked out or otherwise rendered inoperable, and tagged out with a "Do Not Operate" tag during repairs and when operation is hazardous to employees performing maintenance work.

MOTOR VEHICLES, MECHANIZED EQUIPMENT, AND MARINE OPERATIONS

- 1926.600(a)(3) (i) Heavy machinery, equipment, or parts thereof, which are suspended or held aloft by use of slings, hoists, or jacks shall be substantially blocked or cribbed to prevent falling or shifting before employees are permitted to work under or between them. Bulldozer and scraper blades, end-loader buckets, dump bodies, and similar equipment, shall be either fully lowered or blocked when being repaired or when not in use. All

controls shall be in a neutral position, with the motors stopped and brakes set, unless work being performed requires otherwise.

1926.600(a)(3) (ii) Whenever the equipment is parked, the parking brake shall be set. Equipment parked on inclines shall have the wheels chocked and the parking brake set.

1926.601(b) (10) Trucks with dump bodies shall be equipped with positive means of support, permanently attached, and capable of being locked in position to prevent accidental lowering of the body while maintenance or inspection work is being done.

(11) Operating levers controlling hoisting or dumping devices on haulage bodies shall be equipped with a latch or other device which will prevent accidental starting or tripping of the mechanism.

1926.603(a) (5) A blocking device, capable of safely supporting the weight of the hammer, shall be provided for placement in the leads under the hammer at all times while employees are working under the hammer.

INITIATION OF EXPLOSIVE CHARGES-ELECTRICAL BLASTING

1926.906 (j) In underground operations when firing from a power circuit, a safety switch shall be placed in the permanent firing line at intervals. This switch shall be made so it can be locked only in the "Off" position and shall be provided with a short-circuit arrangement of the firing lines to the cap circuit.

(1) When firing from a power circuit, the firing switch shall be locked in the open or "Off" position at all times, except when firing. It shall be so designed that the firing lines to the cap circuit are automatically short-circuited when the switch is in the "Off" position. Keys to this switch shall be entrusted only to the blaster.

POWER TRANSMISSION AND DISTRIBUTION

1926.950 (d) Deenergizing lines and equipment

(1) When deenergizing lines and equipment operated in excess of 600 volts, and the means of disconnecting from electric energy is not visibly open or visibly locked out, the provisions of subdivisions (i) through (vii) of this subparagraph shall be complied with:

(i) The particular section of line or equipment to be deenergized shall be clearly identified, and it shall be isolated from all sources of voltage.

(ii) Notification and assurances from the designated employee shall be obtained that:

(a) All switches and disconnectors through which energy may be supplied to the particular section of line or equipment to be worked have been deenergized;

(b) All switches and disconnectors are plainly tagged indicating that men are at work;

(c) And that where design of such switches and disconnectors permits, they have been rendered inoperable.

(iii) After all designated switches and disconnectors have been opened, rendered inoperable, and tagged, visual inspection or tests shall be conducted to insure that equipment or lines have been deenergized.

(iv) Protective grounds shall be applied on the disconnected lines or equipment to be worked on.

(v) Guards or barriers shall be erected as necessary to adjacent energized lines.

(vi) When more than one independent crew requires the same line or equipment to be deenergized, a prominent tag for each such independent crew shall be placed on the line or equipment by the designated employee in charge.

(vii) Upon completion of work on deenergized lines or equipment, each designated employee in charge shall determine that all employees in his crew are clear, that protective grounds installed by his crew have been removed, and he shall report to the designated authority that all tags protecting his crew may be removed.

(2) When a crew working on a line or equipment can clearly see that the means of disconnecting from electric energy are visibly open or visibly locked-out, the provisions of subdivisions (i) and (ii) of this subparagraph shall apply:

(i) Guards or barriers shall be erected as necessary to adjacent energized lines.

(ii) Upon completion of work on deenergized lines or equipment, each designated employee in charge shall determine that all employees in his crew are clear, that protective grounds installed by his

crew have been removed, and he shall report to the designated authority that all tags protecting his crew may be removed.

1926.957

(b) Deenergized equipment or lines

When it is necessary to deenergize equipment or lines for protection of employees, the requirements of paragraph 1926.950(d) shall be complied with.

XI. APPENDIX E

REFERENCES SUPPORTING GUIDELINES FOR CONTROLLING HAZARDOUS
ENERGY DURING MAINTENANCE AND SERVICING

APPENDIX E

REFERENCES SUPPORTING GUIDELINES FOR CONTROLLING HAZARDOUS ENERGY DURING MAINTENANCE AND SERVICING

A.2.a. - Among the organizations concurring in this requirement are the United Automobile, Aerospace, and Agricultural Implementation Workers of America [2], the American National Standards Institute [5], the National Safety Council [6], the Rubber Manufacturing Association [7], the International Brotherhood of Electrical Workers [8], the American Iron and Steel Institute [9], and the Conveyor Equipment Manufacturers Association [10]. Other supporting references for this first essential guideline are as follows: [7-45].

A.2.b. - Publications supporting this requirement include the German Accident Prevention Specifications (draft) [46] which indicate that the initiation of hazardous movements may result from stored energy and that this stored energy may be in the form of potential or kinetic energy. The ANSI Safety Standard for the Lockout/Tagout of Energy Sources [5] indicates in Section 5.2.5 that all equipment and processes "shall be carefully examined to detect and relieve, disconnect, or restrain any residual energy." The Edison Electric Institute in describing procedures for deenergizing [47] states: "Reliance also should be placed on work procedures which assure the removal of residual energy from lines and equipment before work is begun." Other supporting references are: [3, 15, 17, 19, 22, 23, 25, 26, 31, 35, 37, 39-43, 46-51].

A.2.c.(1) - Physical means of security are utilized in many applications and industries as indicated by the ANSI Safety Standard for the Lockout/Tagout of Energy Sources [5] presentation of a generic lockout procedure. The UAW strongly advocates the use of physical lockouts in their Machinery Lockout Procedures [4]. The National Safety Council describes physical lockout provisions in their Accident Prevention Manual for Industrial Operations [6]. An article entitled "Lockouts Prevent Serious Accidents" in the Industrial Supervisor magazine recommends the use of physical locks [52]. Other references supporting the use of physical means to secure point(s) of control include: [4-6, 8, 9, 11-13, 17, 19, 22-25, 27-30, 34, 37, 38, 45, 47, 51-70].

A.2.c.(2) - The summary of a Panel Presentation on Lockout and Tagout Safety Procedures [11] clearly indicates the current use and acceptability of tagout practices in industry by detailing sample tagout procedures which have proven to be effective. The American Iron and Steel Institute [9] states that tagout procedures have long been acceptable as an alternate to locking procedures in the United States. The Pratt and Whitney Aircraft Group of United Technologies, East Hartford, Connecticut, states that "a tagout system is more reliable than a lock system" for their facility [53]. Other supporting references for using this method of security include: [3, 6, 9, 11-13, 15, 38-41, 43, 44, 47, 48, 53, 54, 58-61, 63, 66, 68-70].

A.2.c.(3) - The Square D Company indicates that minor maintenance, inspection, adjustment, and cleaning tasks can be performed safely with the power off, but not locked or tagged out as long as the operator maintains visual control of the energy control point [12]. A similar instance is adopted by the Wisconsin Electrical Power Company in a letter to the U.S. Department of Labor [48].

The "Report of the Committee on Electrical Safety Requirements for Employee Workplaces" [54] makes specific provisions for performing maintenance functions without benefit of lockout or tagout procedures. Other supporting references are: [9, 12, 35, 40, 45, 48, 51, 54, 58].

A.2.d. - An article in the Plant Engineering magazine [13] describing points to consider when drafting an electrical clearance (lockout/tagout) system states: "The system should indicate that no clearance shall be considered complete until the circuit has been tested with a voltage tester . . ." An article from the Czechoslovakian Occupational Safety Inspection Office Publication entitled Power Switching - Effective Accident Prevention [14] states (after shutoff of the electrical energy): "Before starting such work, however, the parts of the machine involved must be trial started to assure that they are not energized." Monsanto, in its response to the OSHA Advance Notice of Proposed Rulemaking [15], states: "Verification that the system has been deenergized should be established, but the method may vary depending on the energy source." Other references supporting the need for verification include: [3, 6, 9, 13-15, 17, 24-27, 30, 31, 33, 39, 40, 43, 47, 48, 50-52, 54, 57, 58, 64, 71, 72].

A.2.e. - Many procedures were found to state this requirement in one way or another, but three of the best were the UAW "Machinery Lockout Procedures" [4], the ANSI "Safety Standard for the Lockout/ Tagout of Energy Sources" [5], and the "Report of the Committee on Electrical Safety Requirements for Employee Workplaces" [54]. Other supporting references are: [3, 5, 12, 26, 37, 48, 51, 54, 65, 73-75].

A.3.a. - Though not pertaining directly to written procedures, the UAW "Machinery Lockout Procedures" [4] makes the following statement: "Risk of accident will be reduced if workers are not required to rely on memory. . . ." The BSI Code of Practice, "Safeguarding of Machinery" [71], addresses the need for such a criterion as follows: "Oral instructions, requests, or promises are liable to be misheard, misinterpreted, or forgotten and are, therefore, not a satisfactory basis for action on which men's lives may depend." The unsatisfactory working of such procedures has been proven time and again. The American National Standards Institute [5], the Committee on Electrical Safety Requirements for Employee Workplaces [54], and the Manufacturing Chemists Association [16] agree that documented procedures are essential. During emergencies it should be assured that energy is isolated, blocked, dissipated, and secured. Also, provisions for close supervision and validation should be made, because emergency activities can pose serious and unexpected hazards. Actions taken during emergencies should be documented in the event reuse is required. Other references supporting documented procedures are: [3, 5, 8-10, 13, 16, 21, 27, 33, 37, 39-41, 48, 54, 56, 58, 64, 65, 71].

A.3.b. - The UAW "Machinery Lockout Procedures" [4] encourage training for workers in all aspects of safety, including the recognition of hazards as well as safety procedures. The National Safety Council in the Accident Prevention Manual for Industrial Operations [6] emphasizes that ". . . control can be maintained only by constant supervision and by training maintenance men in the safe routine." Both the ANSI Safety Standard for the Lockout/Tagout of Energy Sources [5] and the Report of the Committee on Electrical Safety Requirements for Employee Workplaces [54] emphasize training not only for personnel

actually involved in utilizing the hazard control techniques but also for those supervising and those working in the affected areas. Training is strongly supported by the following references: [5, 6, 9, 12, 21, 26, 27, 32, 37, 39, 41, 45, 48, 54, 56, 58, 62, 69, 71, 73, 74, 76, 77].

B.1. - The requirement is substantiated by noting that ANSI [5] requires that effective protection shall be provided when work is done on energized equipment or systems. Hazardous energy sources must be identified before this requirement can be met. The report of the Committee on Electrical Safety Requirements for Employee Workplaces [54] requires that when work is to be accomplished near energized circuits, employees shall consider all exposed conductors and circuit paths that are dangerous. Other supporting references for energized work include PPG Industries [78], which contains a requirement to "analyze work (in) each specific case for specific potential hazards . . ." Central Soya [79] states ". . . an awareness of potential hazards" is necessary when performing energized work.

B.2. - A letter to OSHA from the Davenport Machine Tool Division [80] states the need for safe operating, setup, and maintenance procedures performed with equipment energized. In a letter to OSHA from the Printing Industries of America, Inc. [81], the statement that "much of the equipment currently used in the printing process is designed to be cleaned, and to a lesser degree repaired, while energized" highlights the need to protect workers from energized equipment. The only way to protect the worker under these conditions is to be sure the procedures used are safe. Additionally, the ANSI Safety Standard for the Lockout/Tagout of Energy Sources [5] states that "where energized work is required, acceptable procedures and equipment shall be employed to provide effective protection to personnel." The terms "acceptable" and "effective protection" indicate a definite need to determine that the procedures used are safe.

B.3. - The documents referred to in the foregoing ([5], [54], and [80]) detail the need for safe procedures and the implied need to demonstrate that these procedures are safe. They also cite the need for training the maintenance workers and their supervisors in the hazards and procedures required to ensure safety. Justification for training workers in how to control hazards to which they would otherwise be exposed should be evident. References supporting safe performance of maintenance on energized systems are: [5, 7, 9, 15, 26, 27, 32, 38, 39, 47, 48, 51, 54, 58, 62, 65, 66, 68, 71, 73, 75, 76, 77, 79-87].

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