

DEPARTMENT OF THE ARMY  
HEADQUARTERS, U.S. ARMY MEDICAL DEPARTMENT CENTER AND SCHOOL  
AND FORT SAM HOUSTON  
Fort Sam Houston, Texas 78234-5014

Memorandum  
No. 385-18

1 September 2000

Safety  
**MACHINE GUARDING**

**1. Purpose.**

a. To provide Fort Sam Houston (FSH) and contractor personnel with guidance in preventing crushed hands and arms, severed fingers, blindness, and inadvertent contact with moving parts of machinery.

b. To establish the Machine Guarding Safety Program.

**2. Applicability.**

a. This memorandum applies to all military, civilian, and contractor personnel assigned, attached, or working at Fort Sam Houston (FSH) to include Camp Bullis and Canyon Lake (collectively referred to in this memorandum as FSH).

b. This memorandum is primarily directed toward stationary machines.

**3. References.**

a. OSHA Standard 29 CFR §1910.211 - 219, Subpart O, Machinery and Machine Guarding.

b. FSH Regulation 385-10, Occupational Safety and Health Program.

c. FSH Memorandum 385-2, Lockout/Tagout Program.

d. FSH Memorandum 385-20, Personal Protective Equipment.

**4. Terminology.** Definitions and specific terminology associated with machine guarding is contained in Appendix A.

**5. Background.** Crushed hands and arms, severed fingers, blindness -- the list of possible machinery related injuries is as long as it is horrifying. There seem to be as many hazards created by moving machine parts, as there are types of machines. Safeguards are essential for protecting workers from needless and preventable injuries.

a. The first step in any operation is to engineer the hazard out of a job as much as possible. However, at times, redesign, replacement, or finding a better way is not feasible or the technical knowledge is not sufficiently advanced.

b. Safeguards are a critical factor in controlling hazards and in preventing accidents. No matter how much training or experience a worker may have, no one can keep his or her mind focused on work every minute.

c. A good rule of thumb is: Any machine part, function, or process, which may cause injury, must be safeguarded.

**6. Policies.**

a. Guards shall be affixed to the machine where possible or secured elsewhere if for any reason attachment to the machine is not possible.

b. The guard shall be such that it does not present an accident hazard in itself.

c. The point of operation of machines whose operation exposes an employee to injury shall be guarded. Machines which usually require point of operation guarding include guillotine cutters, shears, alligator shears, power presses, milling machines, power saws, jointers, portable power tools, forming rolls and calendars.

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

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

f. Machines designed for a fixed location shall be securely anchored to prevent walking or moving.

g. All components of the mechanical system, which transmit energy to the part of the machine performing the work, must be

guarded. These components include flywheels, pulleys, belts, connecting rods, couplings, cams spindles, chains, cranks, and gears.

h. All parts of a machine, which move while the machine is working, must be guarded. These can include reciprocating, rotating and transverse moving parts, as well as feed mechanisms and auxiliary parts of the machine.

**7. Safeguards.** In order to protect workers against mechanical hazards, safeguards must meet these minimum general requirements.

a. Prevent contact: The safeguard must prevent hands, arms, and any other part of a worker's body from making contact with dangerous moving parts. A good safeguarding system eliminates the possibility of the operator or another worker placing parts of their bodies near hazardous moving parts.

b. Secure: Workers should not be able to easily remove or tamper with the safeguard. A safeguard that can easily be made ineffective is no safeguard at all. Guards and safety devices should be made of durable material that will withstand the conditions of normal use. They must be firmly secured to the machine.

c. Protect from falling objects: The safeguard should ensure that no objects can fall into moving parts. A small tool, which is dropped into a cycling machine, could easily become a projectile that could strike and injure someone.

d. Create no new hazards: A safeguard defeats its own purpose if it creates a hazard of its own such as a shear point, a jagged edge, or an unfinished surface which can cause a laceration. The edges of guards, for instance, should be rolled or bolted in such a way that they eliminate sharp edges.

e. Create no interference: Any safeguard, which impedes a worker from performing the job quickly and comfortably, might soon be overridden or disregarded. Proper safeguarding can actually enhance efficiency since it can relieve the worker's apprehensions about injury.

f. Allow safe lubrication: If possible, one should be able to lubricate the machine without removing the safeguards. Locating oil reservoirs outside the guard, with a line leading to the lubrication point, will reduce the need for the operator or maintenance worker to enter the hazardous area.

## **8. Personal Protective Equipment (PPE).**

a. Engineering controls that eliminate the hazard at the source and do not rely on the worker's behavior for their effectiveness offer the best and most reliable means of safeguarding. Therefore, engineering controls must be the employer's first choice for eliminating machine hazards. However, when engineering controls are not available or are not fully capable of protecting the employee, extra measures such as protective clothing and personal protective equipment are necessary.

b. PPE must provide adequate protection such as:

- (1) Appropriate for the particular hazards.
- (2) Maintained in good condition.
- (3) Properly stored when not in use, to prevent damage or loss; and
- (4) Kept clean, fully functional, and sanitary.

c. PPE is available for different parts of the body.

(1) Hard hats can protect the head from the impact of bumps and falling objects.

(2) Caps and hair nets can keep workers hair from being caught in machinery.

(3) Face shields, safety goggles, and safety glasses can prevent contact with splashing coolants or flying particles.

(4) Hearing protection can reduce personnel exposure to hazardous noise levels.

(5) Gloves and special sleeves can protect the worker from cuts or impacts from heavy or rough edged stock.

(6) Safety shoes or other acceptable foot protection can protect the feet from injury in case the worker needs to handle heavy material that could drop.

d. When using PPE, be sure the PPE does not create more of a hazard than protection such as:

(1) A glove which can become caught between rotating parts.

(2) A respirator face piece which hinders the wearer's vision.

(3) Loose fitting shirts that could become entangled in rotating spindles or other kinds of moving machinery.

(4) Jewelry, such as bracelets and rings, can catch on machine parts or stock and lead to serious injury by pulling a hand into the danger area.

## **9. Training.**

a. Even the most elaborate safeguarding system cannot offer effective protection unless the worker knows how to use it and why. Specific and detailed training is a crucial part of any effort to provide safeguarding against machine-related hazards. Thorough operator training should involve instruction and hands-on-training in the following:

(1) A description and identification of the hazards associated with particular machines.

(2) The safeguards themselves, how they provide protection, and the hazards for which they are intended.

(3) How to use the safeguards and why.

(4) How and under what circumstances safeguards can be removed, and by whom (in most cases, repair or maintenance personnel only); and

(5) What to do if a safeguard is damaged, missing, or unable to provide adequate protection.

b. This type of safety training is necessary for new operators, and/or setup personnel, when any new or altered safeguards are put in service, or when workers are assigned to a new machine or operation.

c. Lockout/Tagout procedures for all equipment.

d. Emergency procedures in the event of an accident.

## **10. Responsibilities.**

a. Installation Safety Office (ISO) will:

(1) Administer the Machine Guarding Safety Program.

(2) Conduct an annual review of the program.

(3) Conduct spot checks and inspections.

(4) Assist in training machine users and their supervisors.

b. Contracting Office:

(1) Ensure that machine guarding safety is included in the contracts as appropriate.

(2) Conduct spot checks and inspections.

c. Supervisors will:

(1) Only allow appropriately guarded machines to be used.

(2) Enforce machine guarding safety to include user inspections. (See Appendix B, CSFS Form 4310-E-R, Machine Guarding Checklist.)

(3) Establish a procedure for removing unguarded machines from use.

(4) Establish a machine guarding safety training program.

(5) Ensure machines are effectively guarded and are operated in accordance with safe work practices. (See Appendix C, Types of Machine Guarding.)

(6) Ensure training is documented on the FSH Form 98-E, Employee Safety and Health Training Record.

(7) Promptly report any accidents, incidents, and/or near misses on the FSH Form 96-E, Accident/Incident/Near Miss Report.

d. Employees will:

(1) Observe established safe practices when operating machinery.

(2) Wear and maintain all appropriate PPE.

(3) Not operate machinery when guards are not in place.

(4) Notify supervisor immediately of any unsafe condition due to failure of a safety feature or device on machine.

(5) Know emergency procedures in the event of an accident.

## **Appendix A Definitions**

**Device** - A device is a mechanism or control designed for safeguarding at the point of operation, such as presence-sensing, pull-back, two-hand-trip, etc. devices.

**Barrier Guard** - A device or object that prevents the entry of any part of a person's body and or apparel into the point of operation.

**Guard** - A part or assembly provided for covering a hazard to prevent a worker's hands, or other body part, from going around, under, through or over, and entering the dangerous moving parts of the machinery.

**Holdout or Restraint Devices** - A mechanism, including attachments for operator's hands, that when anchored and adjusted, prevent the operator's hand from entering the point of operation.

**Nip Point** - A point at which a machine element moving in line meets a rotating element in such a manner that it is possible to nip, pinch, squeeze, or entrap a person or objects coming into contact with one of the two members.

**Pinch Point** - Any location at which it is possible for a part of the body to be caught between a moving part and a stationary part of a machine.

**Point of Operation** - The area on a machine where work is actually performed during any process such as shearing, punching, forming, or assembling.

**Presence-Sensing Device** - An electronic safety device designed, constructed and arranged to create a sensing field or area to prevent the operation of the machine when a hand, or any other part of the body, is within such area or field.

**Pull-out-Device** - A mechanism attached to the operator's hands and connected to the machine that is designed to move the operators hands to a safe position away from the point of operation.

**Shear Point** - A shear point is a hazardous area created by a cutting movement of a mechanical part past a stationary point on a machine.

**Appendix B  
Machine Guarding Checklist**

<b>Requirements for all Safeguards</b>	<b>Yes</b>	<b>No</b>
Do the safeguards provided meet the minimum OSHA requirements?		
Do the safeguards prevent worker's hands arms, and other body parts from making contact with dangerous moving parts?		
Are the safeguards firmly secured and not easily removed?		
Do the safeguards ensure that no object will fall into the moving parts?		
Do the safeguards permit safe, comfortable, and relatively easy operation of the machine?		
Can the machine be oiled without removing the safeguards?		
Is there a system for shutting down the machinery before safeguards are removed?		
Can the existing safeguards be improved?		
<b>Point of Operation</b>	<b>Yes</b>	<b>No</b>
Is there a point of operation safeguard provided for the machine?		
Does it keep the operator's hands, fingers, body out of the danger area?		
Is there evidence that the safeguards have been tampered with or removed?		
Could you suggest a more practical, effective safeguard?		
Could changes be made on the machine to eliminate the point-of-operation hazard entirely?		
<b>Power Transmission Apparatus</b>	<b>Yes</b>	<b>No</b>
Are there any unguarded gears, sprockets, pulleys or flywheels on the apparatus?		
Are there any exposed belts or chain drives?		
Are there any exposed set screws, key ways, collars, etc?		
Are starting and stopping controls within easy reach of the operator?		
If there is more than one operator, are separate controls provided?		
<b>Non-mechanical Hazards</b>	<b>Yes</b>	<b>No</b>
Have appropriate measures been taken to safeguard workers against noise hazards?		
Have special guards, enclosures, or personal protective equipment been provided, where necessary, to protect workers from exposure to harmful substances used in machine operation?		

<b>Electrical Hazards</b>	<b>Yes</b>	<b>No</b>
Is the machine installed in accordance with National Fire Protection Association and National Electrical Code requirements?		
Are there loose conduit fittings?		
Is the machine properly grounded?		
Is the power supply correctly fused and protected?		
Do workers occasionally receive minor shocks while operating any of the machines?		
Is Lockout/Tagout required/accomplished when necessary?		
<b>Training</b>	<b>Yes</b>	<b>No</b>
Do operators and maintenance workers have the necessary training in how to use the safeguards and why?		
Have operators and maintenance workers been trained in where the safeguards are located, how they provide protection, and what hazards they protect against?		
Have operators and maintenance workers been trained in how and under what circumstances guards can be removed?		
Have workers been trained in the procedures to follow if they notice guards that are damaged, missing or inadequate?		
<b>Personal Protective Equipment</b>	<b>Yes</b>	<b>No</b>
Is protective equipment required?		
If protective equipment is required, is it appropriate for the job, in good condition, kept clean and sanitary, and stored carefully when not in use?		
Is the operator dressed safely for the job (i.e. , no loose-fitting clothing or jewelry)?		
<b>Machinery Maintenance and Repair</b>	<b>Yes</b>	<b>No</b>
Have maintenance workers received up-to-date instruction on the machines they service?		
Do maintenance workers lock out the machine from its power sources before beginning its repairs?		
Where several maintenance persons work on the same machine, are multiple lockout devices used?		
Do maintenance persons use appropriate and safe equipment in their repair work?		
Is the maintenance equipment itself properly guarded?		

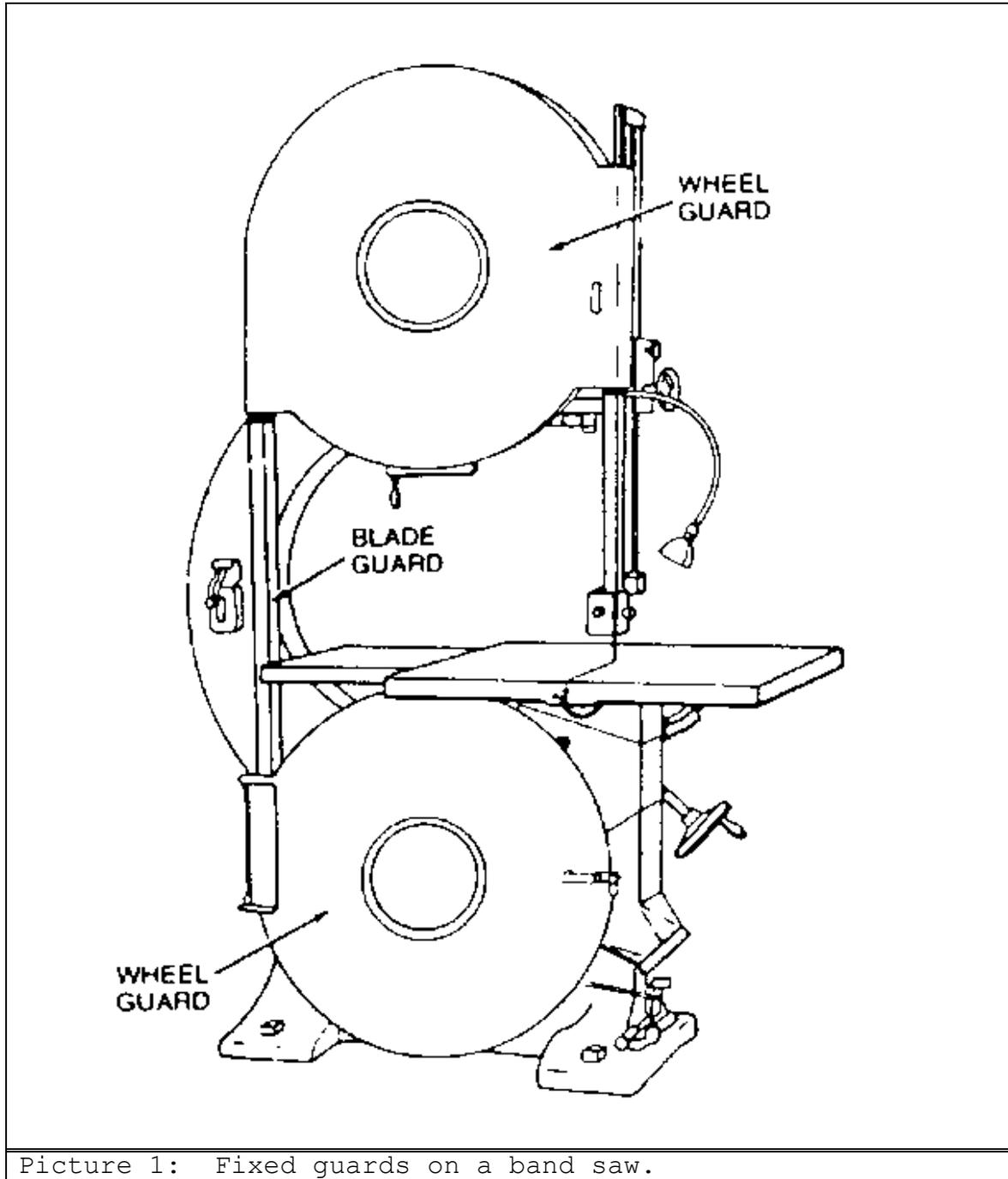
Person performing inspection: \_\_\_\_\_ Date: \_\_\_\_\_

Shop: \_\_\_\_\_ Equipment: \_\_\_\_\_

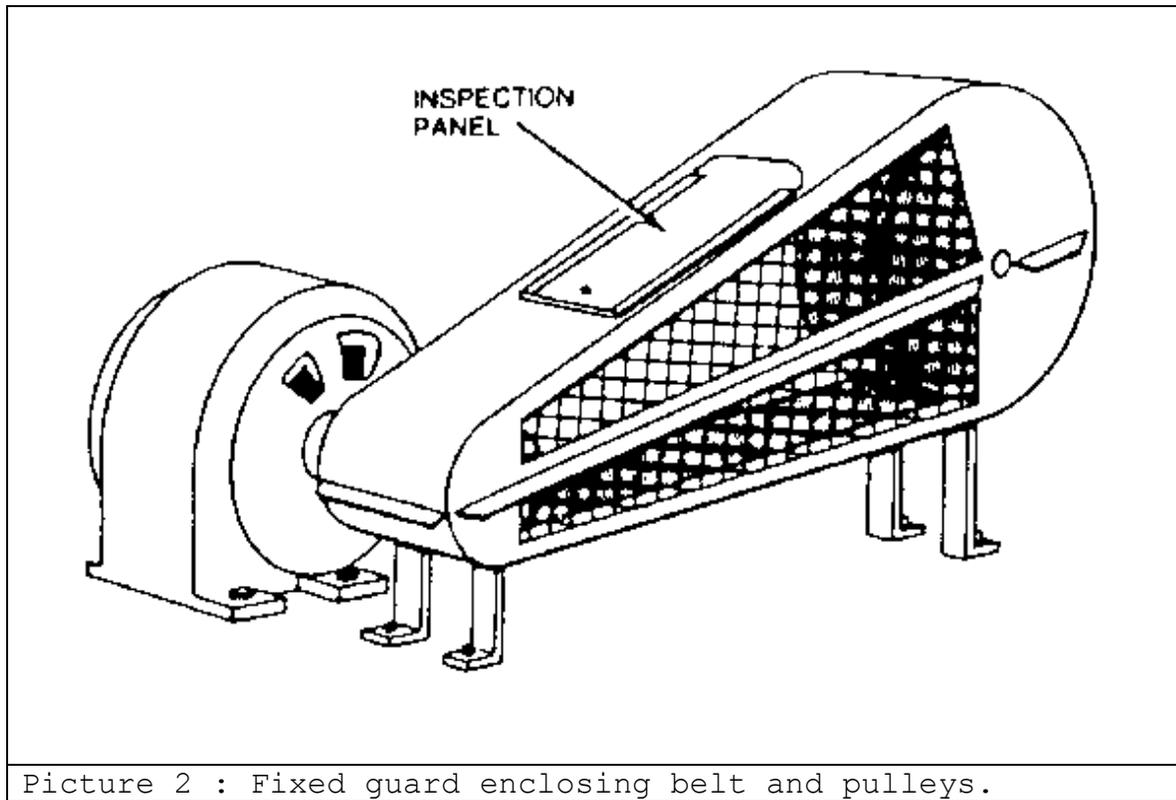
## **Appendix C**

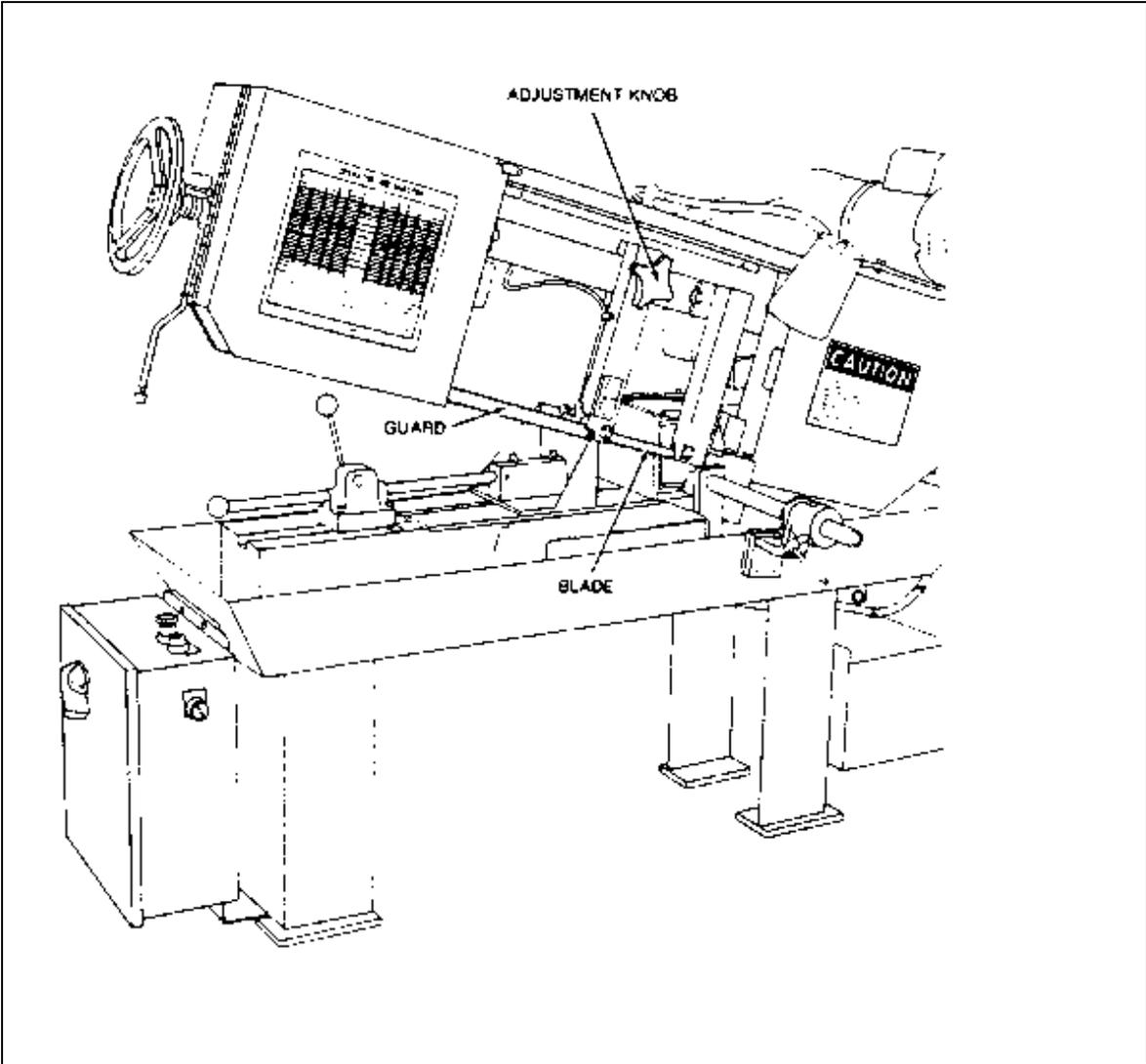
### **Types of Machine Guarding**

- 1. Fixed Guards.** As a general rule, fixed guards that enclose the danger areas best protect a power transmission apparatus. For hazards at the point of operation, where moving parts actually perform work on stock, several kinds of safeguarding may be possible. One must always choose the most effective and practical means available. (See Pictures 1 and 2.)
- 2. Adjustable Guards.** Adjustable guards are useful because they allow flexibility in accommodating various sized of stock. (See pictures 3 and 4.)
- 3. Self-Adjusting.** The movement of the stock determines the openings of these barriers. As the operator moves the stock into the danger area, the guard is pushed away, providing an opening, which is only large enough to admit the stock. After the stock is removed, the guard returns to the rest position. This guard protects the operator by placing a barrier between the danger area and the operator. The guards may be constructed of plastic, metal, or other substantial material. Self-adjusting guards offer different degrees of protection. (See Picture 5.)
- 4. Presence-Sensing.** The photoelectric (optical) presence-sensing device uses a system of light sources and controls, which can interrupt the machine's operating cycle. If the light field is broken, the machine stops and will not cycle. This device must be used only on machines, which can be stopped before the worker can reach the danger area. The design and placement of the guard depends upon the time it takes to stop the mechanism and the speed at which the employee's hand can reach across the distance from the guard to the deeper zone. (See picture 6.)
- 5. Pullback.** Pullback devices utilize a series of cables attached to the operator's hands, wrists, and/or arms. This type of device is primarily used on machines with stroking action. When the slide/ram is up between cycles, the operator is allowed access to the point of operation. When the slide/ram begins to cycle by starting its descent, a mechanical linkage automatically assures withdrawal of the hands from the point of operation. (See picture 7.)

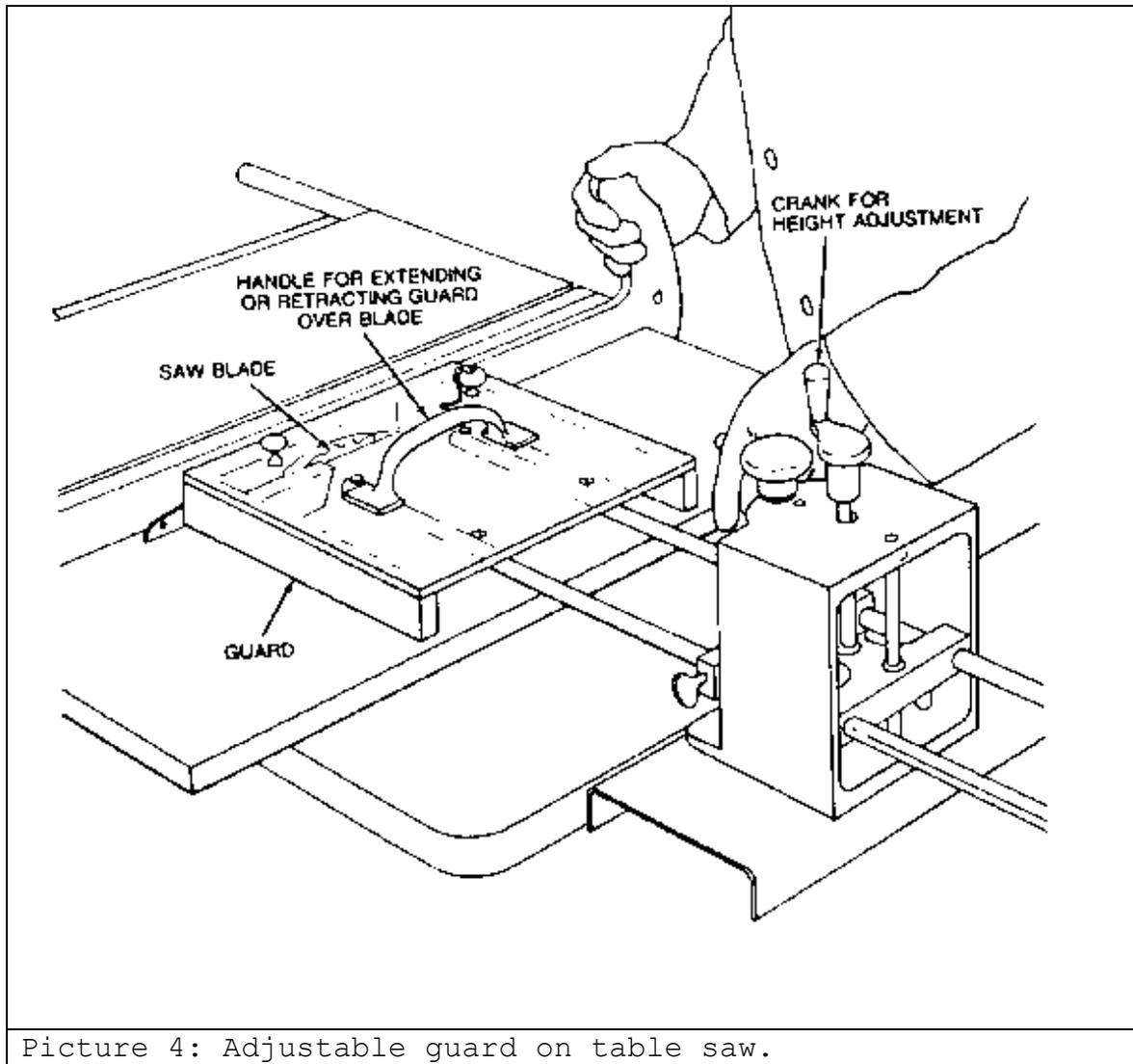


Picture 1: Fixed guards on a band saw.

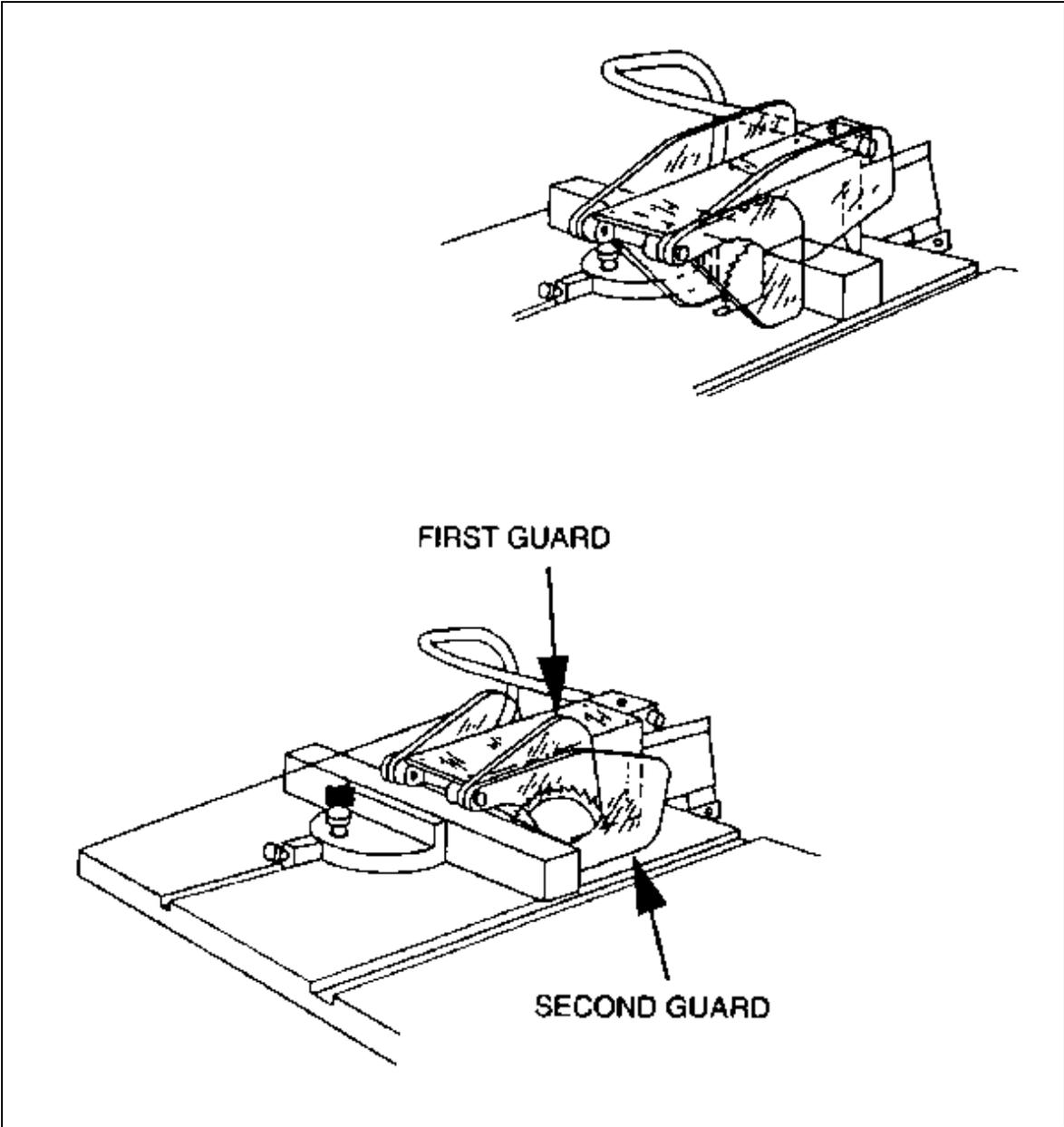




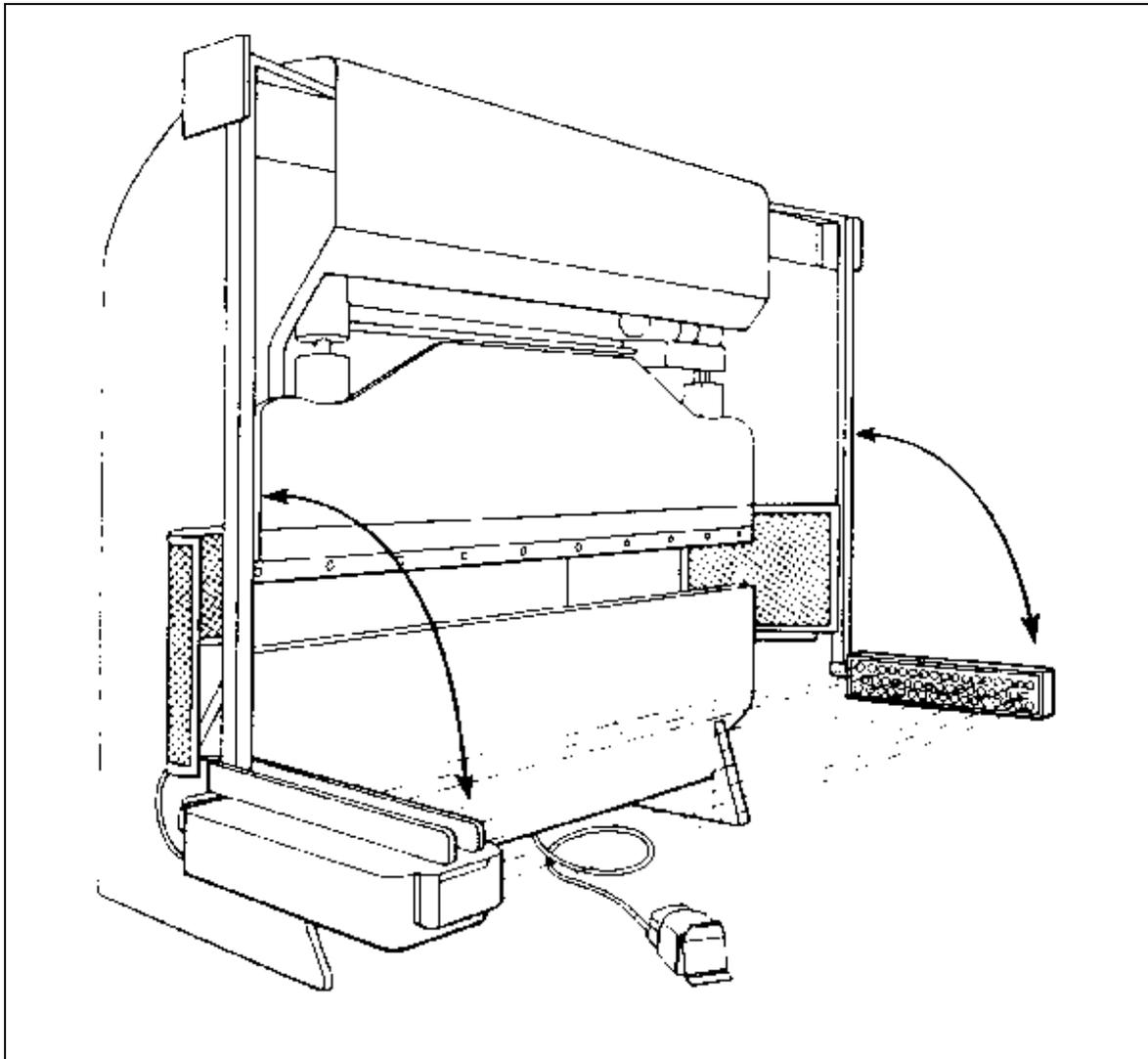
Picture 3: Adjustable guard on table saw.



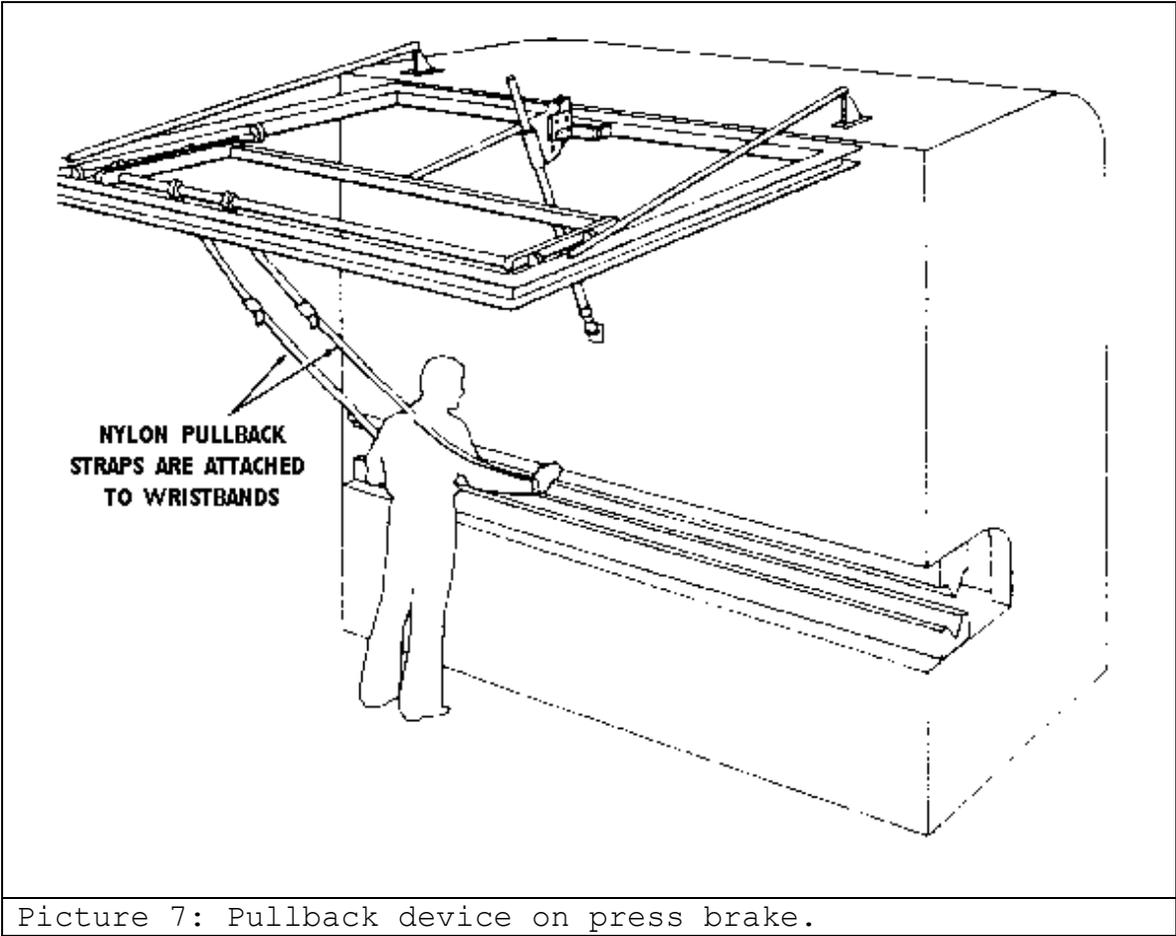
Picture 4: Adjustable guard on table saw.



Picture 5: Self-adjusting guard on table saw.



Picture 6: Photoelectric presence-sensing device on press brake.



(MCCS-BPM-S)

FOR THE COMMANDER:

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