



*OSHA Consultation's  
Guideline for  
Preventing Amputations  
in the Workplace*



**Oklahoma Department of Labor**

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## Preventing Amputations in the Workplace

This guideline has been prepared as an aid to employers and employees to help protect workers against the hazards of moving machine parts that can result in amputation. Amputation is one of the most severe and crippling types of injuries resulting in permanent disability. Approximately one-half of all amputations occur in the manufacturing sector.

In virtually every workplace there are places where workers can reach into machinery and suffer amputation while attempting to align, adjust, inspect, unjam, retrieve fallen parts, lubricate, etc. A National Institute of Safety and Health (NIOSH) study found that 20 to 50 percent of all machines in use are unguarded or poorly guarded at the point of operation. Data from the Bureau of Labor Statistics (BLS) indicate that about 10% of all reported amputations occur among power press operators. Recent OSHA statistics indicate approximately 49% of the injuries on mechanical power presses result in an amputation. Approximately 62% of the power press injuries are from foot-controlled power presses and approximately 30% from hand-activated presses.

Safeguards are essential for protecting workers from needless and preventable injuries. However, existing safeguarding may not provide the desired protection; they may not be adjusted properly: different parts of the machine may need different guards, the guard may be overridden or removed for convenience, dual palm buttons may be too close to the point of operation, etc.

### **A GOOD RULE TO REMEMBER**

Any machine part, function, or process which may cause amputation or other injury must be safeguarded. Where the operation of a machine or accidental contact with it can cause amputation/injury to the operator or others in the vicinity, the hazard must be either controlled or eliminated. Remember also, all new equipment does not necessarily have all the guards on the machine required by OSHA. If not properly guarded, it is the employers responsibility to add the necessary guarding to protect the employee.

## THREE BASIC AREAS NEEDING SAFEGUARDING

**The point of operation**—that point where work is performed on the material, such as pressing, cutting, shaping, boring, or forming of stock.

**Power transmission apparatus**—all components of the mechanical system which transmit energy to the part of the machine performing the work. These components include flywheels, pulleys, belts, connecting rods, couplings, cams, spindles, chains, cranks, and gears.

**Other moving parts**—all parts of the machine which move while the machine is working. These can include reciprocating, rotating, and transverse moving parts; as well as feed mechanisms and auxiliary parts of the machine.



## BASIC TYPES OF HAZARDOUS MECHANICAL MOTIONS AND ACTIONS ARE:

### Motions:

- rotating
- reciprocating
- transverse

### Actions:

- cutting
- punching
- shearing
- bending

## WHAT MUST A SAFEGUARD DO TO PROTECT WORKERS AGAINST MECHANICAL HAZARDS?

They must meet these minimum general requirements:

**Prevent Contact**—Must prevent hands, arms, or any other part of a worker's body from making contact with dangerous moving parts.

**Secure**—Workers should not be able to easily remove or tamper with the safeguard, because a safeguard that can easily be made ineffective is no safeguard at all.

**Protect from Falling Objects**—The safeguard should ensure that no objects can fall into moving parts.

**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.

**Create No Interference**—Any safeguard which impedes a worker from performing the job quickly and comfortably might soon be overridden or disregarded.

**Allow Safe Lubrication**—If possible, one should be able to lubricate the machine without removing the safeguards.



## **REMEMBER THE A.U.T.O PRINCIPLE**

**A**round  
**U**nder  
**T**hrough or  
**O**ver

*A guard must prevent a worker's hands or any part of the body from going around, under, through or over the guard and entering the dangerous moving parts of the machine. The AUTO Principle is the best way to know if the machine is properly safeguarded.*

## **TRAINING**

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 therefore a crucial part of any effort to provide safeguarding against machine-related hazards.

Thorough training should involve instruction and/or hands-on training in the following:

- a description and identification of the hazards associated with particular machines.
- the safeguards themselves, how they provide protection and the hazards for which they are intended.
- how to use the safeguards and why.
- how and under what circumstances safeguards can be removed, and by whom.
- what to do if a safeguard is damaged, missing, or unable to provide adequate protection.

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

## **MACHINERY MAINTENANCE AND REPAIR**

Good maintenance and repair procedures can contribute significantly to the safety of the maintenance crew as well as to that of the machine operators. Training is of utmost importance for maintenance personnel. Don't allow time constraints/deadlines cause employees to by-pass safety procedures such as Lock-out, Tag-out. Make sure all power sources are considered; electrical, mechanical, pneumatic and hydraulic.

## **ACCIDENT INVESTIGATION**

The best place to start an accident investigation is before the accident even has a chance to occur. Many accidents happen after several near-miss incidents. By developing a near-miss reporting program, companies can begin to identify situations which could result in injury.

However, when accidents do occur, it is important to fully investigate them. A good accident investigation is aimed at discovering what happened, what caused it to happen, why it happened, and how to prevent future occurrences. The investigation tries to identify the hazards that led to the accident and any other related hazards that could lead to accidents in the future. Remember, the intent is not to blame the accident on anyone. The main goal is to find the "root cause" of what happened. Identifying the root cause helps to understand why the incident happened, and how we can prevent another similar accident from occurring.

Too often, employers stop at the **apparent** cause for the accident, i.e., employee working too quickly, employee carelessness, guard missing, etc. without looking for the true cause such as: engineering controls not fully in place, safe work practices not enforced, lack of employee training, etc. Too often, employers over look the need for additional machine guarding, proper training, safe work practices or other controls.



## **PROACTIVE WORKPLACE INSPECTION**

All workplaces can be hazard free! With management commitment and employee involvement, it is possible to eliminate hazards and injuries before they ever occur. Amputations are most commonly caused because of the lack of machine guarding. Workplace inspections help to ensure that all guards are present and effective. It is important that workplace inspections be conducted frequently. Facility inspections are a great way to incorporate employees into the safety and health program. Train supervisors and employees on the process of inspecting, then let them make joint inspections. The following checklist contains many of the areas that should be considered when inspecting machine guarding.

## **CHECKLIST**

Answers to the following questions should help determine the safeguarding needs of your workplace, by drawing attention to hazardous conditions or practices requiring correction.

### **REQUIREMENTS FOR ALL SAFEGUARDS**

- Do the safeguards provided meet the minimum OSHA requirements?
- Do the safeguards prevent workers' hands, arms, and other body parts from making contact with dangerous moving parts?
- Are the safeguards firmly secured and not easily removable?
- Do the safeguards ensure that no objects 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 safeguard?
- Is there a system for shutting down the machinery before safeguards are removed?
- Can the existing safeguards be improved?

### **MECHANICAL HAZARDS**

- 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 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?

### **POWER TRANSMISSION APPARATUS**

- 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?

### **OTHER MOVING PARTS**

- Are safeguards provided for all hazardous moving parts of the machine, including auxiliary parts?
- Are portable power tools adequately guarded?

### **TRAINING**

- 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?

## PROTECTIVE EQUIPMENT AND PROPER CLOTHING

- Is personal 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?

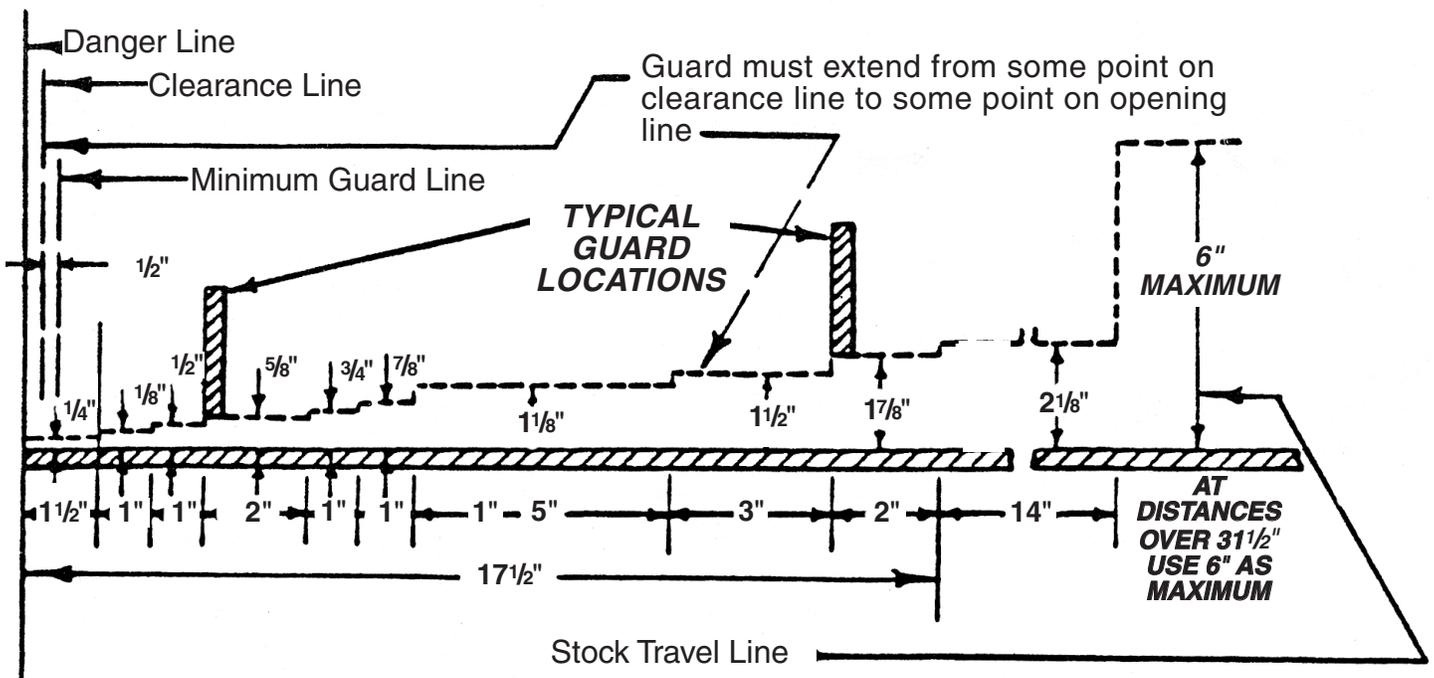


## MACHINERY MAINTENANCE AND REPAIR

- 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 repairs?
- Where 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?

## ACCEPTED SAFE OPENINGS

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





## **OSHA STANDARDS APPLICABLE TO GENERAL MACHINE GUARDING**

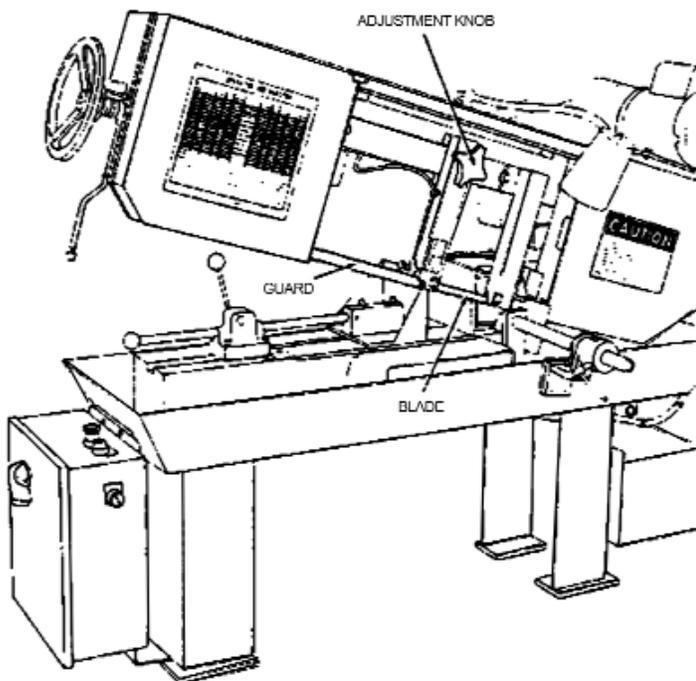
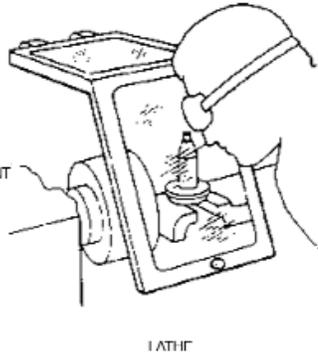
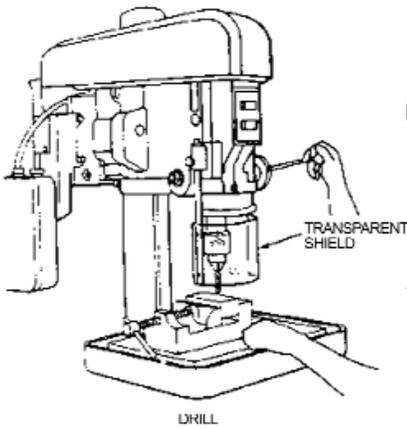
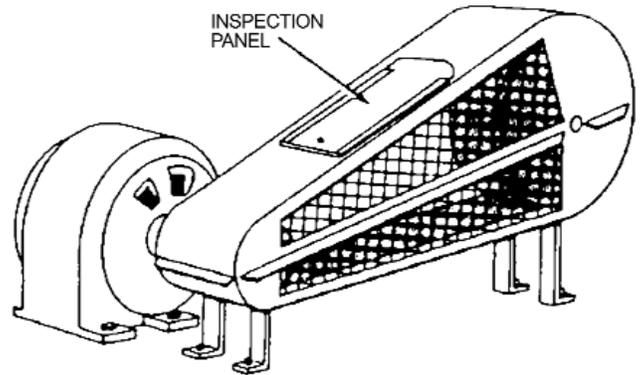
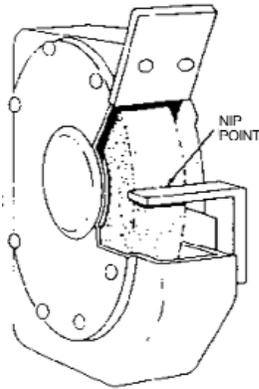
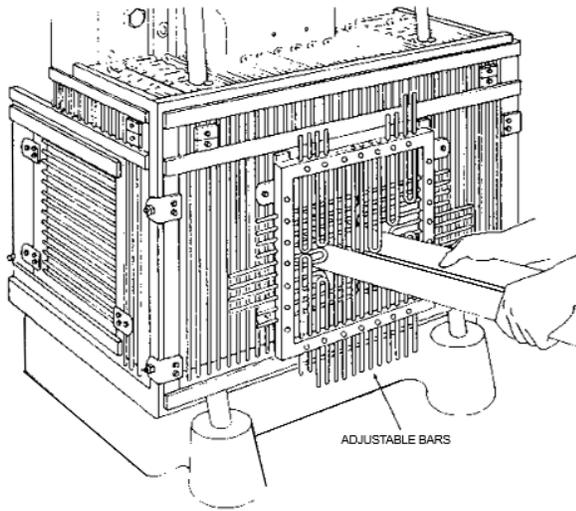
The following table is useful in determining accepted safe openings between the bottom edge of a guard and feed table from point of operation.

**TABLE O-10**

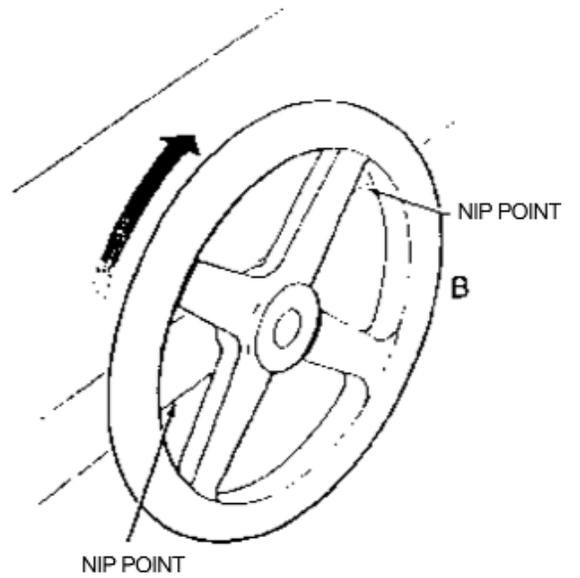
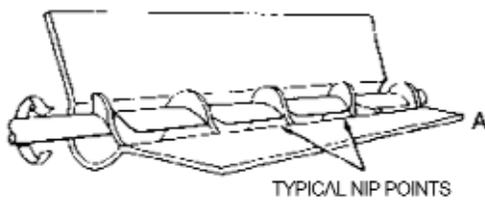
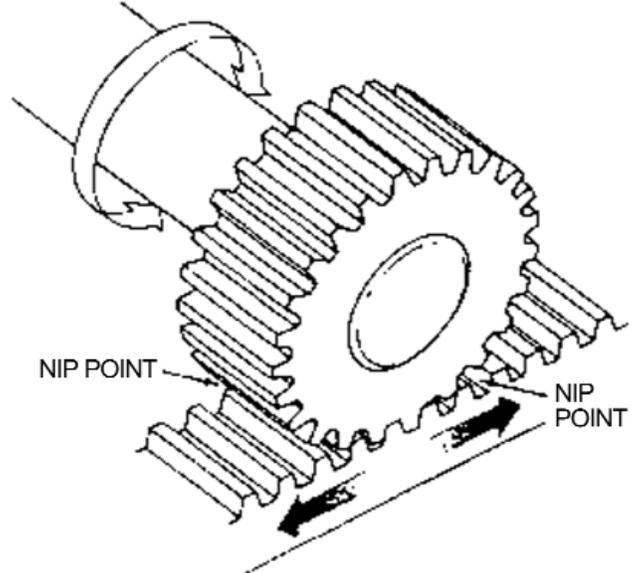
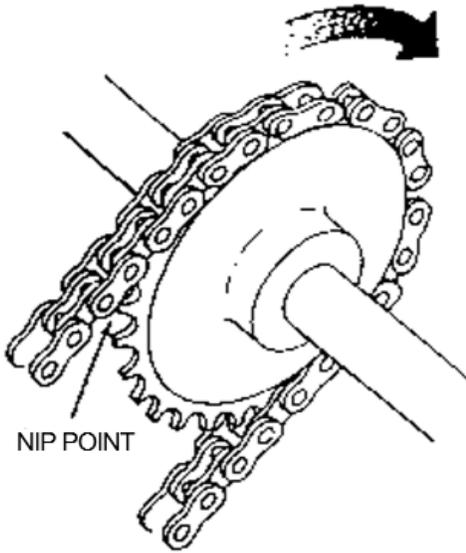
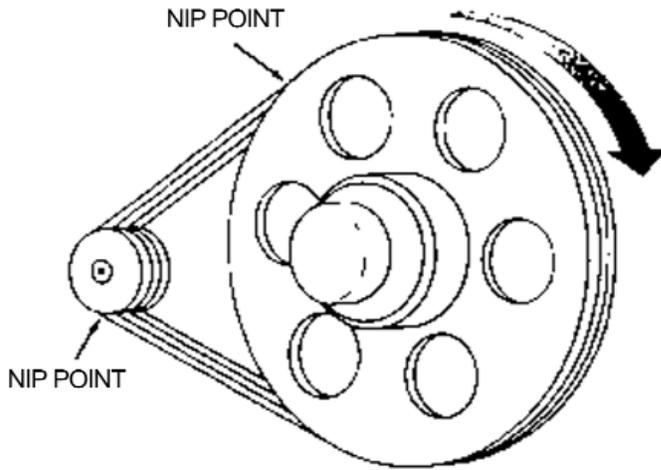
<b>Guarding Distances</b>	
Distance of opening from point of operation hazard [In inches]	Maximum width of opening [In inches]
1/2 to 1 1/2	1/4
1 1/2 to 2 1/2	3/8
2 1/2 to 3 1/2	1/2
3 1/2 to 5 1/2	5/8
5 1/2 to 6 1/2	3/4
6 1/2 to 7 1/2	7/8
7 1/2 to 12 1/2	1 1/4
12 1/2 to 15 1/2	1 1/2
15 1/2 to 17 1/2	1 7/8
17 1/2 to 31 1/2	2 1/8

Source 29CF4R1910.217

# EXAMPLES OF PROPERLY GUARDED MACHINES/EQUIPMENT



# AREAS NEEDING GUARDS



## **SUMMARY**

Through this document, we have explored the more common causes of amputations in the workplace. It is imperative that employers take all reasonable steps necessary to protect workers from this serious and devastating type of injury. Amputations can be prevented by guarding the point of operation, by adequately training employees, implementing and enforcing safe work practices, and by inspecting the workplace frequently. A working, effective safety and health program can help assure that all of these steps are taken.

For more information on preventing amputations, ensuring your workplace is protected from amputations and other hazards, or for assistance developing an effective safety and health program, contact the OSHA Consultation service at:

<b>Oklahoma City office</b>	<b>(405) 528-1500</b>
<b>Tulsa office</b>	<b>(918) 581-2400</b>
<b>Statewide, toll-free</b>	<b>(888) 269-5353</b>





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