



Machine Guarding Plan

Florida Institute of Technology (Florida Tech)

Environmental Health & Safety (EH&S)

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REVISION HISTORY

Revision Number	Revision Date	Revised By	Description of Change
00	2020-02-04	Charles Cherrito	Initial plan creation and implementation.
01	2021-02-08	Selvin McLean	Document review; review of federal register for updates. Website links update/addition.

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PURPOSE

Moving machine parts have the potential to cause severe workplace injuries or death, such as crushed fingers or hands, amputations, burns, or blindness. Safeguards are essential for protecting workers from these preventable injuries. Any machine part, function, or process that may cause injury must be safeguarded. When the operation of a machine or accidental contact can injure the operator or others in the vicinity, the hazards must be eliminated or controlled.

This Plan provides guidance on safety requirements related to machine safeguards which are used to protect employees from injury during the operation of machines and equipment.

SCOPE

This Plan applies to all employees at Florida Tech who work in areas where potential exposures to any machine where parts, functions, or processes may cause an injury.

RESPONSIBILITIES

Environmental, Health & Safety (EH&S)

- Ensures this Plan and its associated documentation is maintained.
- Assists supervisors in developing training materials related to this Plan.
- Reviews the effectiveness of this Plan to make sure that it satisfies the requirements of all applicable federal, state, or local requirements.
- Assists with or completes assessments and inspections.

Supervisors

- Ensures that all machines/equipment contain safeguards to protect employees (level of safeguarding is per a [Job Hazard Analysis](#)).
- Ensures employees follow safe work practices when working with or near machines.
- Ensures employees do not remove safeguards or operate machines without safeguards in-place.
- Ensures safe operating and maintenance procedures are current. There should be SOP's on routine maintenance procedures for all equipment requiring machine guards.
- Responsible for ensuring Lock Out Tag Out procedures are followed by trained personnel.
- Ensure all employees are properly trained before operating machinery and receive training as ongoing when duties or the machine changes.
- Must maintain all training records for all employees.

Employees

- Prior to using a machine, thoroughly review the Operation and Maintenance Manual.
- Operates machines with all safeguards in place and follows all applicable safety requirements (e.g., lockout/tagout, if applicable).
- Understands hazards related to machines being worked-on and proper safeguarding methods.
- Participates in all [required training](#).
- Reports any unsafe conditions to their supervisor immediately.

DEFINITIONS

Device:

A press control or attachment that restrains the operator from inadvertently reaching into the point of operation.

Enclosure:

Guarding by fixed physical barriers that are either mounted on or around the moving parts of the machine/equipment.

Fencing:

A locked fence or rail enclosure that restricts access to the machine, except by authorized personnel. The dangerous operation of the machinery must be at least 42 inches away from the fencing.

Guard:

A barrier (fixed or movable) that prevents contact with moving parts. Guards are more protective and are preferred over devices.

In-going Nip Points:

Two or more mechanical components rotating in opposite directions in the same plane and in close conjunction or interaction.

Pinch Point:

Any place where a body part can be caught between two or more moving parts.

HAZARDOUS PARTS AND/OR MOTIONS

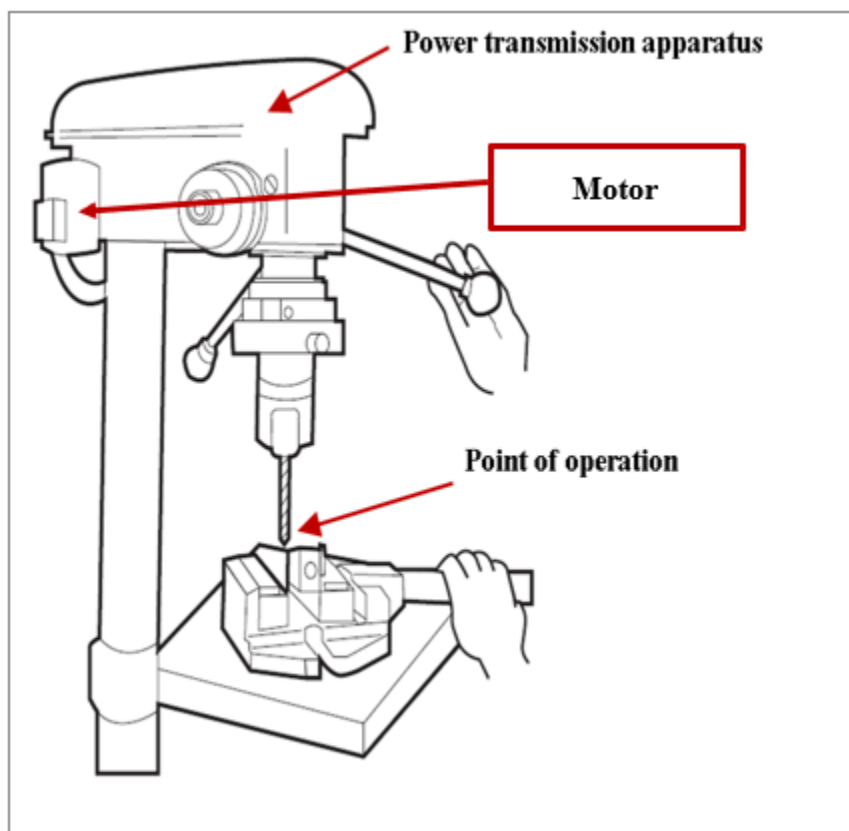
The parts of machines and/or equipment that are potential hazards vary from unit-to-unit. Some of the common contributing factors that can result in occupational injuries are as follows:

❖ Point of Operation

The point of operation is the location where material is positioned, inserted, or manipulated, or where work such as shearing, punching, shaping, cutting, boring, forming, or assembling is being performed on the stock material. Milling machines, power presses, CNC turning machines, jointers, power saws, hand tools, guillotine cutters, and shears are all examples of machines that require point of operation guards.

❖ Power Transmission Apparatus

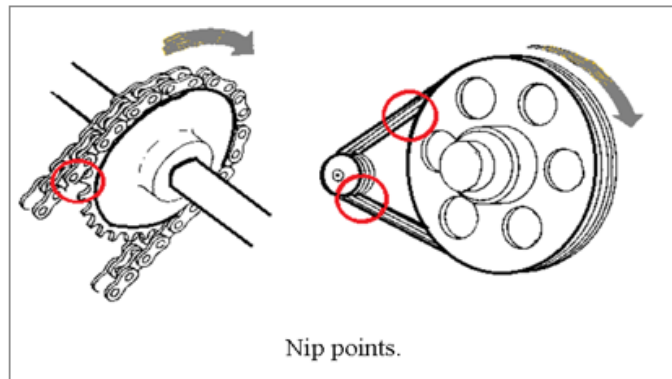
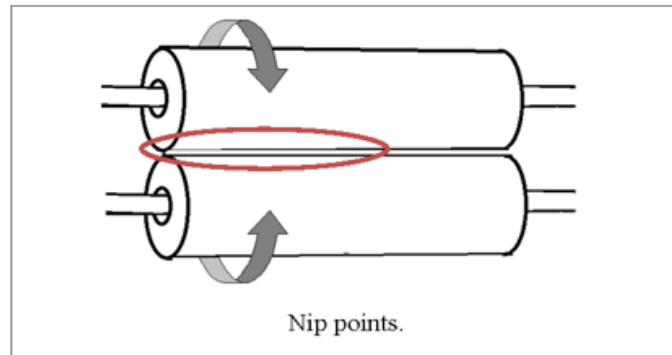
Power transmission apparatus are all components of the mechanical system which transmit energy from the motor to the location and part of the machine performing the Motor. These components include flywheels, pulleys, belts, connecting rods, couplings, cams, spindles, chains, crank, and gears.



❖ Hazardous Motions

Different types of mechanical motions are found on nearly every machine in various combinations. Recognizing these hazards is the first step toward protecting workers.

- ✓ Rotating motion can grip hair and clothing, pulling a worker into a hazardous position. Projections (such as set screws and bolts) or nicks and abrasions exposed on rotating parts increases the hazard.
- ✓ In-running nip point hazards are caused by the rotating parts on machinery. Parts can rotate in opposite directions while their axes are parallel to each other.



- ✓ Reciprocation motions may be hazardous because, during the back-and-forth or up-and-down motion, a worker may be struck by or caught between a moving and a stationary part.
- ✓ Transverse motion (movement in straight, continuous line) creates a hazard because a worker may be struck or caught in a pinch or shear point by the moving part in relation to a nearby fixed object.

❖ **Hazardous Actions**

- ✓ Cutting action may involve rotating, reciprocating, or transverse motion. The danger of cutting action exists at the point of operation where finger, arm and body injuries can occur and where flying chips or scrap material can strike the head; particularly, in the area of the eyes or face

- ✓ Punching action results when power is applied to a slide (ram) for blanking, drawing, or stamping metal or other materials. The danger of this type of action occurs at the point of operation where stock is inserted, held, and withdrawn by hand.

- ✓ Bending action results when power is applied to a slide to draw or stamp metal or other materials. A hazard occurs at the point of operation where stock is inserted, held, and withdrawn.

- ✓ Shearing action involves applying power to a slide or knife to trim or shear metal or other materials. A hazard occurs at the point of operation where stock is physically inserted, held, and withdrawn.

❖ **Other Areas of Hazards**

The below examples are additional hazards in which guarding may be required to mitigate their exposure.

- ✓ Compressed Gases
- ✓ Hydraulic Fluids
- ✓ Utilities (steam or water piping/hoses, and electrical)
- ✓ Counterweights, Loaded-Springs, Shock Absorbers
- ✓ Temperature Extremes

SAFEGUARDING METHODS

Guards must be placed on machines to protect operators and other employees in the area from hazards. The primary ways for safeguarding equipment are installing a **GUARD** or **DEVICE**.

❖ **Guard Installation (Prevents Entry)**

Guards are preferred over devices. There are 4 types of guards:

Fixed: This type of guard is a barrier or enclosure that permits material entering into the operation zone, but not the operator's body or body parts. Fixed guards are not dependent upon moving parts to perform its intended function.

Interlocked: When this type of guard is opened or removed, the tripping mechanism and/or power automatically shuts off or disengages, and the equipment cannot operate until the guard is back in place.

Adjustable: This type of guard is adjustable and protects the operator by placing a barrier between dangerous areas and the operator.

Self-adjusting: This is similar to an adjustable guard, except that it is automatic, and the opening is determined by the movement of parts of the equipment.

❖ **Device Installation (Controls Entry)**

Devices may replace or supplement guards, however, to qualify as a device, it must perform one of the following functions:

1. Stop the equipment if any part of the body is inadvertently placed into equipment.
2. Restrain or withdraw the operator's hands during operation.
3. Require the operator to use both hands-on equipment controls.
4. Provide a barrier which is synchronized with the operating cycle of the equipment to prevent entry during the hazardous part of the cycle.

Examples of devices include:

Gate: A moveable barrier that protects the operator at the point of operation before the equipment can be started.

Presence Sensing Device: These devices either stop the equipment, or will not start the cycle, if a hand or any part of the body is inadvertently placed into a dangerous area.

Safety Trip Controls: These devices provide a quick means for deactivating the equipment in an emergency.

Two-Hand Control/Trip: These devices prevent the operator from reaching into the point of operation by requiring concurrent pressure of operator's control buttons to activate the equipment.

When guards or devices cannot be used, there are additional methods that can be used such as fencing, safe distance, safe opening, and safe position of controls. These additional methods do not provide the same level of protection of guards or devices. They depend upon specific procedures, work rules, training, and/or supervision to prevent entry into dangerous areas.

GUARD GUIDELINES

Guards designed and installed by the machine/equipment manufacturer are best; however, guards installed onto machines/equipment are still necessary if they are not installed by the manufacturer (e.g., on older machines/equipment). These retro-fitted guards must be designed, built, and/or installed to fit the machine/equipment properly. If possible, manufacturer approval should be obtained prior to retrofitting a machine. If the manufacturer is no longer in business, and a replacement is not available, the retrofitted design should be approved by a professional engineer that specializes in mechanical engineering.

Metal is the best material for guards, but plastic guards or safety glass may be used where visibility through the guard is required.

Wood guards are generally not recommended because of their flammability and lack of durability and strength. In areas where corrosive chemicals are used, wood guards may be the best choice.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

The type of PPE utilized will depend on the potential hazards. A [Job Hazard Analysis](#) (JHA) will determine the best PPE for the task. Some examples of PPE are as follows:

- **Hard Hats** offer of bumps and falling objects when the operator is handling stock.
- **Caps and Hair Nets** keep the operator's hair from being caught in machinery.
- **Face Shields, Safety Goggles, Glasses** protect from splashes or particles.
- **Hearing Protection** may be needed when operators operate noisy machines.
- **Special Sleeves and Gloves** can protect hands and arms.
- **Safety Shoes and Boots**, or other acceptable foot guards, shield the feet against injury.

It should be noted that employees should be aware some clothing can present safety hazards (Example: loose-fitting shirts can become entangled or jewelry may catch in rotating parts).

EQUIPMENT MAINTENANCE

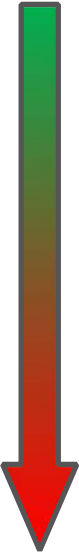
All equipment must be properly maintained per the manufacturer's and/or the equipment owner's requirements. All Florida Tech employees and contractors shall follow Lockout/Tagout (LOTO) procedures for shutting down equipment prior to removing any safeguards or accessing any equipment where they could be exposed to hazardous moving machine parts.

If maintenance requires testing or adjustment of equipment with its safeguards removed, equipment specific procedures should be developed and followed for performing the task safely. After maintenance is complete, replace safeguards before equipment restart.

HAZARD CONTROL HIERARCHY

Before a machine or process is implemented, risk reduction measures must be considered. By using the Hazard Control Hierarchy chart below during a Job Hazard Analysis, departments can select the most appropriate risk reduction measures.

HAZARD CONTROL HIERARCHY

	PROTECTIVE MEASURES	EXAMPLES	INFLUENCE ON RISK FACTORS	CLASSIFICATION
<p>Most Effective or Preferred [LOWER RISK]</p>  <p>Least Effective or Preferred [HIGHER RISK]</p>	Elimination or Substitution	<ul style="list-style-type: none"> Eliminate pinch points (increase clearance) Intrinsically safe (energy containment) Automated material handling (robots, conveyors, etc.) Redesign the process to eliminate or reduce human interaction Reduced energy Substitute less hazardous chemicals 	<ul style="list-style-type: none"> Impact on overall risk (elimination) by affecting severity and probability of harm May affect severity of harm, frequency of exposure to the hazard under consideration, and/or the possibility of avoiding or limiting harm depending on which method of substitution is applied 	Design Out
	Guards and Safeguarding Devices	<ul style="list-style-type: none"> Barriers Interlocks Presence sensing devices (light curtains, safety mats, area scanners, etc.) Two hand control and two-hand trip devices 	<ul style="list-style-type: none"> Greatest impact on the probability of harm (Occurrence of hazardous events under certain circumstance) Minimal if any impact on severity of harm 	Engineering Controls
	Awareness Devices	<ul style="list-style-type: none"> Lights, beacons, and strobes Computer warnings Signs and labels Beeepers, horns, and sirens 	<ul style="list-style-type: none"> Potential impact on the probability of harm (avoidance) No impact on severity of harm 	Administrative Controls
	Training and Procedures	<ul style="list-style-type: none"> Safe work procedures Safety equipment inspections Training Lockout / Tagout 	<ul style="list-style-type: none"> Potential impact on the probability of harm (avoidance and/or exposure) No impact on severity of harm 	
	Personal Protective Equipment (PPE)	<ul style="list-style-type: none"> Safety glasses and face shields Ear plugs Gloves Protective footwear Respirators 	<ul style="list-style-type: none"> Potential impact on the probability of harm (avoidance) No impact on severity of harm 	PPE

AREAS OF CONCERN

The below areas have the potential of injury due to the characteristic equipment being used. Therefore, they are examples of equipment and/or areas where machine guarding is required at Florida Tech. This is not an all-inclusive list but rather some examples.

Food Dining Services:

Mixers

Slicers

Vertical Food Processor

Machine Shop:

Press Drills

Miter Saws

Grinding machines

Metal lathes

Milling machines

TRAINING

All at-risk employees must be trained on the specific machine/equipment involved in their daily duties. Each employee who works with or is potentially exposed to machines/equipment which requires safeguarding will receive training to ensure they are familiar with the reason, installation, operation, and removal of machine safeguards and to ensure they understand and are able to follow all requirements in this Plan.

There are a variety of ways that employees can receive training. Aside from reading this Plan, they can take the Florida Tech online training “Machine Guarding” for a general understanding of machine guarding safety or an in-person training with their supervisor may suffice. No matter how training is performed, each employee shall receive training on the specific equipment they are tasked with operating. All training must be documented and retained by each department.

Additional topics the machine/equipment specific training must include are as follows:

- Description and identification of the hazards associated with specific machines.
- The safeguards used, how they provide protection, 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.
- They are to understand that safeguards shall not be removed or defeated.

REFERENCES

OSHA: [1910 Subpart O - Machinery and Machine Guarding](#)

OSHA: [1910.212 Machinery and Machine Guarding](#)

OSHA: [Machine Guarding](#)