A. POLICY
This policy was developed to familiarize participants with the general safety concepts and requirements necessary to work safely around machinery. This document is designed to ensure that Alvernia University employees and students follow procedures which assure that equipment or machines are operated safely and meet state, federal, and industry machine guarding standards.

B. SCOPE AND APPLICATION
This policy applies to all University employees and students who may work with, or adjacent to, equipment or machines that may pose a safety hazard.

C. DEFINITIONS
“Machines” include, but are not limited to, fans, compressors, bench grinders, fuel pumps, dumpsters, trash compactors, and table saws. Any machine part, function, or process which may cause injury must be safeguarded. When the operation of a machine or accidental contact with it can injure the operator or others in the vicinity, the hazards must be either controlled or eliminated.

A "machine hazard" occurs at the point of operation where the actual work is performed, and can be created by:
- components which transmit energy, such as pulleys, belts, chains, gears, couplings, or flywheels; or
- other parts which move while the machine is working, including reciprocating, rotating, and transverse parts.

“Point of operation” means the point at which the machine does the work for which it is designed. For example, the point of operation for a saw is where the cutting occurs.

“Power apparatus” means the source, such as a motor, that generates the forces that allow the machine the power to complete its work.

“Power transmission apparatus” means the mechanisms, such as belts and gears, that allow the power to get from the power apparatus to the point of operation.

D. HAZARDOUS MECHANICAL MOTIONS AND ACTIONS
A wide variety of mechanical motions and actions may present hazards to the user. These can include the movement of rotating members, reciprocating arms, moving belts, meshing gears, cutting teeth, and any part that may impact or shear.

The basic types of hazardous mechanical motions and actions are:
1. Motions
   - Rotating (including in-running nip points)
   - Reciprocating
   - Transversing
2. Actions
   - Cutting
   - Punching
   - Shearing
   - Bending
Motions

Rotating motion can be dangerous; even smooth, slowly rotating shafts can grip clothing, and through mere skin contact, force an arm or hand into a dangerous position. Injuries due to contact with rotating parts can be severe.

Collars, couplings, cams, clutches, flywheels, shaft ends, spindles, meshing gears, and horizontal or vertical shafting are some examples of common rotating mechanisms which may be hazardous. The danger increases when projections such as set screws, bolts, nicks, abrasions, and projecting keys or set screws are exposed on rotating parts.

In-running nip point hazards are caused by the rotating parts on machinery. There are three main types of in-running nips.

1. Parts can rotate in opposite directions while their axes are parallel to each other. These parts may be in contact (producing a nip point) or in close proximity. In the latter case, the stock fed between the rolls produces the nip points. This danger is common on machines with intermeshing gears, rolling mills, and calenders.
Examples of in-running nip points:

<table>
<thead>
<tr>
<th>Gears</th>
<th>Rolling Mill</th>
<th>Calender</th>
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</table>

2. Nip points are also created between rotating and tangentially moving parts. Some examples would be: the point of contact between a power transmission belt and its pulley, a chain and a sprocket, and a rack and pinion.

Examples of rotating nip points:

<table>
<thead>
<tr>
<th>Belt and Pulley</th>
<th>Chain and Sprocket</th>
<th>Rack and Pinion</th>
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3. Nip points can occur between rotating and fixed parts which create a shearing, crushing, or abrading action. Examples are: spoked handwheels or flywheels, screw conveyors, or the periphery of an abrasive wheel and an incorrectly adjusted work rest.
Reciprocating 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 a straight, continuous line) creates a hazard because a worker may be struck or caught in a pinch or shear point by the moving part.

**Actions**

Cutting actions 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. Such hazards are present at the point of operation in cutting wood, metal, or other materials.
Examples of mechanisms involving cutting hazards include bandsaws, circular saws, boring or drilling machines, turning machines (lathes), or milling machines.

Punching action results when power is applied to a slide (ram) for the purpose of 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. Typical machines used for punching operations are power presses and iron workers.

Shearing action involves applying power to a slide or knife in order to trim or shear metal or other materials. A hazard occurs at the point of operation where stock is actually inserted, held, and withdrawn. Examples of machines used for shearing operations are mechanically, hydraulically, or pneumatically powered shears.

Bending action results when power is applied to a slide in order to draw or stamp metal or other materials. A hazard occurs at the point of operation where stock is inserted, held, and withdrawn. Equipment that uses bending action includes power presses, press brakes, and tubing benders.

E. SAFEGUARDING

Where mechanical hazards occur, dangerous moving parts in these five areas need safeguarding:

1. The point of operation - that point where work is performed on the materials, such as cutting, shaping, boring, or forming of stock.

2. 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.

3. In-running nip points – machines that feed themselves from continuous stock generate a hazard where the moving material passes adjacent to or in contact with moving parts. Nip points can occur where belts contact pulleys and gears mesh.

4. Rotating or reciprocating machine parts - all parts of the machine which move while the machine is in operation. These can be transverse moving parts, as well as feed mechanisms and auxiliary parts of the machine.

5. Flying chips, sparks or other moving parts – machines that throw off chips or sparks from the area of the point of operation. Flying objects can occur from broken manufactured pieces and be hurled at the operator.

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 lacerations. The edges of guards should be rolled or bolted in such a way that they eliminate sharp edges.

Requirements for Safeguards

Safeguards must meet these minimum general requirements:

1. Prevent contact: The safeguard must prevent hands, arms, and any other part of a operator'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.
2. Be secured to the machine: Operators 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. 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.

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

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

5. Create no interference: Any safeguard that impedes an operator from performing the job quickly and comfortably might soon be overridden or disregarded. Proper safeguarding may actually enhance efficiency since it relieves the operator's apprehensions about injury.

6. Allow safe lubrication: If possible, workers 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 operator to enter the hazardous area.

F. TYPES OF GUARDS
The main types of machine guards are:
1. Guarding by location or distance
   Protecting the operator from the danger zone by setting up the operation sequence where the operator is located away from the danger.
2. Trip bars
   Devices that stop the machinery should the employee trespass into the danger area.
3. Fixed barriers
   Machine guards that are attached directly to the machinery frame.
   1. Interlocked barriers
      Electrical interlocks that disable the actuating mechanism whenever the machine guard is opened.
   2. Adjustable barriers
      Similar to fixed-barrier guards, the adjustment is temporary, and the same guard can be reshaped later for a different setup.
3. Gates
   Similar to guards, but they open and close with every machine cycle.
4. Presence-sensing devices
   Utilizes a row of photoelectric cells that creates a “force field" and once that field is disrupted, the cells will immediately stop the machine.

G. HIERARCHY OF MACHINE GUARDING
Machine guarding decisions should be made in the following order of preference:
- Design out or eliminate the hazard.
- Physically "engineer out" the exposure to the hazard.
- Guard the hazard. Require personal protective equipment.
- Use warning devices, or make the danger "manifest".
- Use warning signs.
- Use safe working practices and procedures.

H. EXAMPLES OF MACHINES THAT UTILIZE MACHINE GUARDS

1. Power Presses / Drill Presses
   The fixed barrier guard is a very popular method of guarding presses. A guard must be installed on every mechanical power press.

2. Grinding Machines
   - The work-rest bar in front of the grinding machine must remain in close adjustment (within \(1/8\text{th\ inch}\)) to the wheel.
   - The tongue guard on top of the grinding machine must remain adjusted to within \(1/4\text{th\ inch}\).
   - The grinding wheel must remain sufficiently guarded.

   The possibility of the grinding wheel disintegrating while spinning at high speeds can cause serious, even fatal, injuries.

3. Saws
   Saws present the most obvious hazards – amputation. Some typical saws (Radial and Table) utilize some form of guarding to prevent contact with the cutting blade. In a shop
setting, often the cutting blade is fixed and rotates, while the material is fed or pushed against the blade. Some examples of guards include:

- **Hood guards** - Not only used as protection against the blade, but protect the employee from flying chips and objects.

- **Push sticks** - Used to provide distance and space so the employee will not use their hands to feed material past the saw blade.

- **Spreaders (splitters)** - Maintain the saw kerf (cut) open or spread apart in the completed cut portion so that the material will not contact the blade, in order to prevent kickback. Spreaders must be attached to remain in true alignment with the saw, even when either the saw or table is tilted.
• Anti-kickback fingers - Designed to arrest kickback motion in order to keep the material from being tossed across the room or into the user.

4. Hydraulic Trash Compactor

• Interlock control switch - prevents operation of the compacting ram unless the door is closed and the receptacle is in the compacting position.

I. GENERAL REQUIREMENTS
a. Setup/Preparations
• Operators must not wear jewelry, loose-fitting clothing, neckties, or other apparel that may become caught in machinery.
• Keep long hair that could be caught by moving parts pulled back or covered.
• Tool rests, tongue guards, and deflection shields should be properly adjusted before grinding wheels are operated. When chipping or using a portable grinder, utilize portable shielding to protect other workers.
• Before starting any machine, ensure the controls are set to run within safe specifications.
• Machine guards shall be adjusted to expose the minimum amount of cutting head or blade to complete the work.

b. Operating Machines
• Tools and equipment shall not be left unattended while parts are still in motion or machinery is in a "cocked" or midcycle status.
• When operating a power-driven machine, stop the machine whenever it is necessary to divert attention away from the workpiece.
• Do not manually adjust and gauge (caliper) work while the machine is running.
• Keep fingers away from moving machine parts. Never reach over dangerous moving parts or lean over the work so that hair or clothing can become entangled in rotating parts.
• Use brushes, vacuum equipment, or special tools to remove chips and shavings from near a cutting tool. Never use hands or rags that can be caught by moving parts.
• Stop the machine when it is necessary to clean, oil, or adjust the equipment.
• Never attempt to stop a machine by using the hand or any part of the body as a brake.
• Only the proper hand tools should be used. Tools should be kept in their proper location (such as a tool rack or rest).
• An exhaust system or other provisions on woodworking machinery should ensure removal of sawdust and debris prior to the accumulation becoming a danger to employees.
• Push sticks shall be used where appropriate (i.e. stripping, cutting small parts, etc.)
• Hydraulic trash compactor:
  o Only trained employees are authorized to use the trash compactor
  o Never place any body part past the threshold of the hopper
  o If an item must be moved inside the compactor, use a long stick
  o Never climb inside the compactor for any reason
  o Never open the door while the compactor is running
  o Never put flammable, explosive, or hazardous materials in the compactor

C. Machine Repair and Maintenance
All repairs or maintenance of University machines and equipment shall be performed by authorized personnel only. The equipment shall not be operated until the safety issue has been resolved.
Servicing and maintenance of Alvernia University equipment and machinery shall be done per the Alvernia University Control of Hazardous Energy (“Lockout-Tagout”) Program.

J. RESPONSIBILITIES
1. The Alvernia University Environmental Health & Safety Manager is responsible for:
   • preparing and updating the written Machine Guarding Program and
   • responding to any employee or student machine guarding concerns or questions.
   • providing training on machine guarding to all employees and students who work with or near machinery

2. Alvernia University employees who use University equipment and machines are responsible for:
   • reporting any unguarded machine hazards to their supervisor and the Environmental Health & Safety Manager immediately.
### ALVERNIA UNIVERSITY

**OSHA REGULATION:** 29 CFR 1910.212 MACHINERY AND MACHINE SAFEGUARDING  

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<th>SECTION</th>
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<th>EFFECTIVE DATE</th>
<th>REVISION DATE</th>
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<td>2</td>
<td>8/25/2009</td>
<td>4/1/2014</td>
</tr>
</tbody>
</table>

- forwarding any student concerns or observations regarding the lack of machine guarding to their supervisor and the Environmental Health & Safety Manager.  
- conducting assigned tasks in a safe manner, wearing appropriate personal protective equipment (PPE), and only using equipment for which they have been trained.  
- employees shall not start or use a machine unless all guards are in place.  
- Employees shall not bypass or disable guards or other safety features of the equipment  
- employees shall not engage in practical jokes, horseplay, wrestling, throwing objects, air hose games, loud unnecessary noises, or unusual commotion.  
- immediately cleaning up any slippery substance such as oil, grease, water, etc. spilled on the floor.  
- attending training on machine guarding if employee works with or near machinery

3. Alvernia University students who use University equipment and machines are responsible for:  
- reporting any unguarded machine hazards to their supervisor and the Environmental Health & Safety Manager immediately.  
- conducting assigned tasks in a safe manner, wearing appropriate personal protective equipment (PPE), and only using equipment for which they have been trained.  
- students shall not start or use a machine unless all guards are in place.  
- students shall not bypass or disable guards or other safety features of the equipment  
- students shall not engage in practical jokes, horseplay, wrestling, throwing objects, air hose games, loud unnecessary noises, or unusual commotion.  
- immediately cleaning up any slippery substance such as oil, grease, water, etc. spilled on the floor.  
- attending training on machine guarding if student works with or near machinery.

### K. Personal Protective Equipment

All individuals who work with Alvernia University machinery must wear appropriate Personal Protective Equipment (PPE). Safety goggles complying with ANSI Z87.1, Practice for Occupational and Educational Eye and Face Protection, are excellent for operations that may generate flying objects. Face shields are not adequate if there are flying objects but do help if there is dust. Face shields may be necessary in addition to goggles on some operations. Safety glasses with side shields may also be effective.

Safety shoes must be worn in designated areas and while performing specific tasks where injury potential to the top of the foot is high.

Gloves shall **not** be worn while operating machinery with rotating or reciprocating parts. Gloves may be worn while loading and unloading parts and tooling.

Hearing protection shall be worn when working with machines and equipment with a noise level greater than 85 decibels (dB).
Dust masks should be worn to protect the employee or student from respiratory exposure to solid particulates (i.e. dust). Dust masks are not respirators and do not fall under the Alvernia University Respiratory Protection Program. Employees and students who may be exposed to mists, vapors, gases, or liquid particulates should contact the Alvernia University Environmental Health & Safety Manager regarding use of a respirator.

L. REFERENCES
2. Code of Federal Regulations, Title 29, Part 1910.133 Eye and Face Protection
4. Code of Federal Regulations, Title 29, Part 1910.135 Head Protection
8. ANSI Z87.1, Practice for Occupational and Educational Eye and Face Protection
9. Alvernia University Respiratory Protection Program
10. Alvernia University Control of Hazardous Energy Program