

Machine Shop Safety for Academic Departments

Guideline

Revision Date: 08/11/21

Applies To: All University academic departments. Employees and *non-employees* who actively work in *machine shops*, laboratories and other University facilities with machining tools and machining equipment are covered under this guideline.

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Machine Shop Safety for Academic Departments Guideline Statement

The purpose of the Machine Shop Safety Guideline is to provide a University Standard for safety and administrative controls for individuals who work with machining tools and equipment. This guideline is derived from government regulations, the [Academic Laboratory and Research Safety Policy](#) and best practices from research studies.

It provides guidance for safe handling of machines and how to develop a shop-specific policy addressing training and oversight for specific pieces of equipment, room, and equipment access requirements, general rules and responsibilities of shop users and a process for student project review (if applicable).

Post the shop-specific policy in the shop (for review or reference) or its location noted.

Related Machine Shop Safety for Academic Departments Guideline Documents

EHS Guideline, [Lock-out/Tag-out - Control of Hazardous Energy Sources](#)

EHS Guideline, [Personal Protective Equipment, General](#)

Additional Resources

All reference guidelines, regulations, and other documents are available in [Appendix A](#) of this document.

For information about machine shop personnel responsibilities, see [Appendix B](#) of this document.

Unit-Specific Machine Shop Safety Policy Development

Each shop must develop a policy regarding training requirements and oversight necessary for specific pieces of equipment, room and equipment access requirements, general rules and responsibilities of shop users and a process for student project review (if applicable). This policy should be posted within the shop (for review or reference) or its location noted. A [template](#) is provided for an Academic Machine Shop Safety Policy that can be modified to the specific shop's requirements.

The [Classification Matrix for Academic Machine Shop Equipment](#) document can be used as general guidance for development of the unit-specific shop policy. This can be implemented in a manner that best suits the individual department/unit's needs, but the Responsible Person must establish clear requirements for access to the equipment and/or shop as well as providing for a means to restrict unauthorized users from using equipment that they have not been trained to operate.

Potential Hazards

A machine shop contains the same hazards as one experiences in a laboratory, such as, but not limited to the following hazards:

POTENTIAL HAZARD	EXAMPLES
Physical	Injuries from compressed gas, flying debris, noise, pinching, cutting, and falling.
Electrical	Fire and shock
Fire	Flammable chemicals and sparks
Chemical	Toxic liquids, fumes, gas, and dust

Training Requirements

Only *authorized machine tool users* as defined by this Guideline are permitted to operate machining tools in U-M facilities. To become an authorized machine tool user, individuals must complete the following training prior to using the machinery and associated equipment:

PERSONNEL	TRAINING REQUIRED	PROVIDED BY
<i>Machine Shop Responsible Person</i> (Responsible Person)	Machine Shop Responsible Person (My LINC IHS070w)	EHS
<i>Machine Shop Monitor</i> (Monitor)	Machine Shop Responsible Person (My LINC IHS070w)	EHS
Authorized Machine Tool Users	<ul style="list-style-type: none">• <i>Basic machine shop safety</i>• Specific machine tool and equipment	Responsible Person or Monitor

Developing a Basic Machine Shop Safety Training Program

The Responsible Person or Monitor must train the authorized machine tool users. The Responsible Person or Monitor must have thorough knowledge about and experience with the following topics:

- How the individual machining tools and equipment operate
- The safety hazards associated with the machining tools and equipment
- Specific actions to take in case of an emergency

The training should include the following topics at a minimum.

- Unit-specific Machine Shop Policy
- Hazard Communication (online)
- Use of personal protective equipment (PPE)
- Applicable prohibitions (e.g., loose clothing, hair, gloves and jewelry, etc.)
- *Guard* use/positioning
- Machining tool and bit maintenance
- *Hand tool* and facility safety
- Machine shop general safety rules and equipment specific guidelines should also be included in the basic training program.
 - [General Shop Dress](#)
 - [General Shop Safety Rules](#)
 - [Lathe Safety Guidelines](#)
 - [Mill Safety Guidelines](#)
 - [Drill Press Safety Guidelines](#)
 - [Bench or Pedestal Grinder Safety Guidelines](#)
 - [Planer Safety Guidelines](#)
 - [Band Saw Safety Guidelines](#)
 - [Table Saw Safety Guidelines](#)

Shop equipment will require Tool Specific Training, which should include instruction and hands-on demonstration of the following topics: Refer to the document [Classification Matrix for Academic Machine Shop Equipment](#) for guidance about the length and type of training for specific machines.

- Description and identification of the hazards associated with a particular machine;
- Proper safety precautions when working with a particular machine;
- Limitations of the tools/equipment/materials and when and what not to use;
- Safeguards, protection they provide, and ensuring their presence before using a machine;
- What to do if a damaged guard, missing part, unusual noise, etc., is noticed.
- How to use the emergency buttons and other measures, when necessary.
- Maintenance (as applicable) and cleaning procedures.

Proficiency Testing

Based on the unit-specific Machine Shop Policy, certain tools or machines may also require proficiency testing prior to being deemed an “authorized machine tool user.” Proficiency determinations may be evaluated through completion of a shop project or through extensive hands-on training/oversight as determined by the Responsible Person.

Recordkeeping

Individual departments must maintain training records on authorized machine tool users. Training records must include the specific machining tool or other equipment the individual was trained on, date of training, U-M ID number and the signature of trainee and trainer.

The [Machine Shop Usage Agreement and Training Documentation Form](#) is an example of a form that can be used to document both the Basic Machine Shop Safety Training and Tool Specific Training for an individual user.

This training information shall be posted in the designated machine shop, other machine tool user area, or maintained in a central location.

Individuals will be classified as "Authorized Machine Tool Users" upon completion of training and documented departmental training records. The Responsible Person will determine what method of identification will be used to distinguish between authorized users and those who have not been authorized.

Re-Training

Re-training shall be provided if there is a change in job assignment, change in machine tool or equipment use, or additional jobs present new hazard(s). Re-training may also occur if the Responsible Person/Monitor or EHS determines that it is necessary.

Emergency Response Training

First Aid training is recommended, but is not a requirement, for the Responsible Person/Monitor. At a minimum, a stocked first aid kit should be available in or near the shop area.

Each shop’s Responsible Person/Monitor are also encouraged to obtain Fire Extinguisher training by contacting EHS’s Fire Safety Service (EHS-FSS) group at (734) 615-6764.

Shop Access

All University students and employees, i.e., professors, researchers, must have received formal machine shop safety training and be a designated "Authorized Machine Tool User" prior to access and use of machining tools and machining equipment in machine shops and other University facilities.

Buddy System

In accordance with this Guideline, the designated Responsible Person shall implement a mandatory "buddy" system for all Authorized Machine Tool Users while working in machine shops, laboratories, or other University facilities that have machining tools or equipment.

Establish Hours of Operation

Employee and student use of machine shops and facilities with machining tools and equipment shall be limited to established hours of operation. Using machining tools and equipment beyond established working hours and during weekends by Authorized Machine Tool Users is prohibited unless the designated Responsible Person has issued prior written approval.

Departments are strongly encouraged to limit after-hours usage of power equipment after midnight due to increased fatigue factors associated with late night working.

Shop Inspections

In addition to normal oversight and review of the shop area on a continual basis, the Responsible Person shall conduct annual machine tool, associated equipment, and facility safety inspections. Inspection criteria shall be based on manufacturer's recommendations and in accordance with state safety regulations listed in the reference regulation section of this document.

All machine tools and equipment that are in violation of applicable safety standards, EHS Guidelines or unsafe in any manner shall be removed from service and locked out until properly repaired or replaced.

Recordkeeping

Documentation of these inspections shall be maintained by the department and be made available to EHS upon request.

Machine Tool and Equipment Servicing

Individual departments must have a formal Lock-out/Tag-out procedure established prior to servicing or repairing any piece of machinery or equipment in a machine shop or other University facility.

The Lock-out/Tag-out procedure shall be formulated in compliance with the EHS Guideline, [Lock-out/Tag-out - Control of Hazardous Energy Sources](#).

Machine Shop Safety Signage and Postings

At a minimum, applicable and appropriate safety signs, tags, stickers and other postings shall be provided, installed and maintained in all areas where a person or equipment operator might be, or would likely be, injured if not alerted to the hazard. [Free safety posters, stickers, and cards](#) are available online through MIOSHA. Machine safeguarding placards are also available from EHS.

Consideration should also be given to using signs and labels based on the American National Standards Institute's (ANSI) [Z535.4 Standard for Product Safety Signs](#) and [Labels](#) or [ISO 3864](#), both which specify the use of symbols which have the ability to communicate hazards across language barriers.

EHS Door Sign

The posting of an informational door sign on the outside of each entrance to a shop is also strongly encouraged. The use of a U-M door sign is an important part of emergency response. Emergency responders use these signs to determine the primary hazards in the room and the emergency contact person. The sign would include current emergency contact information including contact names, office location, and work and home phone numbers. To obtain a door sign, complete the online [Shops/Studios Request Form](#) on EHS's Forms webpage (<http://ehs.umich.edu/forms/shopstudio-door-sign-request-form/>) or contact EHS at (734) 647-1143.

Project Review

Another element to consider incorporating into a shop's safety program is the use of a [Project Review Form](#). This form can be used by shop's Responsible Persons and Monitors to review and sign off on student's and other machine user's projects and ideally would include project description, anticipated machines, tools, materials, etc., potential safety concerns, and safety measures to be taken to address the concerns.

Appendix A: Reference Regulations

- University of Michigan Standard Practice Guide (SPG [605.1](#))
 - MIOSHA General Industry:
 - [Part 1. General Provisions](#)
 - [Part1A. Abrasive Wheels](#)
 - [Part 7. Guards for Power Transmission](#)
 - [Part 11. Polishing, Buffing and Abrading](#)
 - [Part12. Welding and Cutting](#)
 - [Part 26. Metalworking Machinery](#)
 - [Part 27. Woodworking Machinery](#)
 - [Part 33. Personal Protective Equipment](#)
 - [Part 38. Hand and Portable Powered Tools](#)
- OSHA:
- [Safeguarding Equipment and Protecting Employees from Amputations](#)
 - [Machine Guarding e-Tool](#)

Appendix B: Responsibility

Everyone working at the University of Michigan has the right to expect a safe and healthy work environment. They also have a responsibility to help assure a safe and healthy environment for themselves and others. These responsibilities are detailed in the University of Michigan Academic Laboratory and Research Safety Policy, issued jointly by the Department of Environment, Health & Safety (EHS) and the Office of Research Ethics & Compliance (UMOR). Please click on the Policy link to view role specific responsibilities including but not limited to the following categories:

- All faculty, staff, other employees and students
- Graduate Student Research Assistants/Trainees
- Post-Doctoral Trainee/Fellow
- Laboratory Director (Faculty/Lab Manager/Supervisor)
- Department Chair
- Facility Managers/Department Managers/Key Administrators/Chief Department Administrators
- Unit (School/College/Department) Safety Coordinators

Deans, Directors and Department Heads

- Ensure that machine shops are located in *adequate facilities* to allow for safe operation and layout of equipment.
- Designate and authorize an individual who has thorough knowledge of proper machine operation and safe working procedures as the Responsible Person.
- Implement a unit-specific Machine Shop Safety Policy that incorporates all of the quality elements of the University Standard provided in this guideline.
- Actively support and enforce their unit-specific Machine Shop Safety Policy.
- Ensure an environment where supervisors and other personnel are encouraged to follow this Guideline.
- Inform the Department of Environment, Health & Safety (EHS) of the designated Responsible Person.

Machine Shop Responsible Person (Responsible Person)

- Prepare and implement a unit-specific Machine Shop Safety Policy.
- Manage and enforce all aspects of the unit-specific Machine Shop Safety Policy and activities that impact machine shop safety. Examples of these activities include user training, proper use of personal protective equipment (PPE), project review, removal of unsafe machines from service, posting of appropriate signage at work areas, access controls, and approval of users.
- Designate individuals with the appropriate training and experience to function as Monitors to provide oversight and training as necessary to support the Machine Shop Safety Policy.
- Complete EHS's Machine Shop Responsible Person Training Program and ensure that all designated Monitors complete the training as well. Go to EHS's [My LINC training website](#) and log-in, in order to access this training module (IHS070w).
- Train and credential all machine tool users in the proper and safe machining tool and equipment use.
- Maintain training documentation on all authorized machine tool users.
Limit access to tools, equipment and the shop. Individuals using machining tools and equipment beyond established working hours and during weekends shall be prohibited unless prior written

approval is given by the Responsible Person and use complies with the “buddy system” part of this section.

- Conduct self-inspections and preventative maintenance (PM) of machining tools, equipment and facilities at a minimum of once a year and in accordance with manufacturer’s recommendations. Maintain documentation of inspections and the preventative maintenance performed.
- Develop a Lock-out/Tag-out (LOTO) procedure for all equipment as needed and follow the procedures prior to servicing or repairing any piece of machinery or equipment. Refer to EHS’s LOTO webpage and Guideline: [Lock-out/Tag-out - Control of Hazardous Energy Sources](#).
- Provide eye protection and enforce its use to authorized machine tool users and visitors upon entry into a machine shop.
Post, provide or maintain in an accessible location, the standard operating procedures (SOPs) and manuals for each piece of equipment, as appropriate.
- Act as a safety liaison between the individual department and EHS with the implementation of this Guideline and all other aspects of machine shop safety.
- Establish allowable material use specific for the type of machine, application and environment.
- Consider a policy regarding the consumption, storage and preparation of food and drink within shop areas, e.g., areas where it is prohibited due to the presence of certain hazardous operations or in areas where hazardous materials are being used or stored while potentially allowing food and drink in other designated areas.
- Report all work related injuries and illnesses to the Work Connections office within 24 hours by completing and faxing the [Illness and Injury Report Form](#) to (734) 936-1913.
- Complete the [Incident/Near Miss Report Form](#).

Machine Shop Monitors

- Enforce unit-specific machine shop policy and administrative controls for a machine shop as designated by the Responsible Person.
- Complete EHS’s Machine Shop Responsible Person Training Program. Go to EHS’s [My LINC training website](#) and log-in, in order to access this training module (IHS070w).
- Provide machine tool user training and maintain documentation of training as necessary.
- Provide oversight of equipment/authorized machine tool users.
- Report all work related injuries and illnesses to the Work Connections office within 24 hours by completing and faxing the [Illness and Injury Report Form](#) to (734) 936-1913.
- Complete the [Incident/Near Miss Report Form](#)

Authorized Machine Tool Users

- Comply with this Guideline and any further recommendations initiated by the Responsible Person or Monitors.
- Conduct assigned tasks in a safe manner, wear appropriate personal protective equipment (PPE), and only use equipment for which they have been formally trained.
- Report any job related injuries or illnesses, questions on health and safety, or any unsafe or unhealthy working or equipment conditions to their supervisor and/or Responsible Person (or Shop Monitor).
- Individuals will be classified as "Authorized Machine Tool Users" upon completion of all applicable equipment, tool and safety training and documented departmental training.

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- Operate only the specific machines, tools and equipment they have been trained to use, in the manner in which they were trained and the manner in which the equipment was intended to be used.
 - Must not wear loose clothing or exposed jewelry while using any machining tool or piece of equipment. Pull back and secure long hair prior to using machining tools and equipment.
 - Report to the Responsible Person/Monitor any defective machinery, equipment and hazardous conditions. Do not use the equipment until proper repairs have been made.
 - Do not remove or deactivate guards or other safety devices including safety signage or other postings from machinery and equipment except when necessary for servicing.
 - Do not modify machinery or equipment, including guards and other safety features including safety signage or other postings.
 - Do not change blades, bits, abrasive wheels/belts/discs or other similar tools at the points of operation unless specifically trained to do so and all applicable LOTO and other procedures are followed.

EHS

- Monitor conformance with this Guideline, and performance of unit-specific Policy.
- Provide Responsible Person/Monitor training and maintain documentation of training.
- Conduct machining equipment and facility inspections periodically.
- Provide copies of state regulations and EHS guidelines upon request.
- Provide technical support on all aspects of this Guideline.
- Review and revise the University Machine Shop Safety for Academic Departments Guideline, as needed.
- Conduct an incident investigation, using EHS's After-Action Review Form, when appropriate.

Attachment 1: Machine Shop Forms and Machine-Specific Checklists

- [Academic Machine Shop Safety Policy Template](#)
- [Classification Matrix for Academic Machine Shop Equipment](#)
- [Project Review Form](#)

Machine-Specific Checklists

- [General Shop Dress](#)
- [General Shop Safety Rules](#)
- [Lathe Safety Guidelines](#)
- [Mill Safety Guidelines](#)
- [Drill Press Safety Guidelines](#)
- [Bench or Pedestal Grinder Safety Guidelines](#)
- [Planer Safety Guidelines](#)
- [Band Saw Safety Guidelines](#)
- [Table Saw Safety Guidelines](#)

Glossary of Terms

TERM	DEFINITION
Adequate Facility	A facility which provides satisfactory clearances, power, light, and ventilation according to the above regulations.
Authorized Machine Tool User	An employee or non-employee who has received both “basic machine shop safety training” and specific machine tool & equipment training by the Machine Shop Responsible Person (Responsible Person) or Machine Shop Monitor (Monitor), and is thus authorized to access and use the specific machining tools and equipment using established procedures.
Basic Machine Shop Safety Training	Training program developed by the Machine Shop Responsible Person and provided to each user of the machine shop. Contents of the training program are detailed under the Training Requirements section of the guideline. Training must be documented and maintained on file by the Responsible Person and should be available upon request by EHS.
Buddy System	A system designed to protect the machine tool user in case of injury or other incident. A "buddy", i.e., is another Authorized Machine Tool User, Responsible Person or Monitor that is required to be present so that, in the event of an injury, emergency assistance is not delayed. Any modification to the buddy system must be reviewed on a case by case basis by EHS.
Guard	An enclosure designed to restrain pieces of abrasive wheels, wheel pulley assemblies, other moving parts or working stock, and to protect the employee in the event of breakage or accidental contact with the moving part.
Hand Tool	An instrument used or worked by hand.
Lockout	Means to secure by use of a lock.
Lock-out/Tag-out (LOTO)	The placement of a lock/tag on an energy-isolating device in accordance with an established procedure ensuring that the energy-isolating device cannot be operated until removal of the lock/tag.
Machine Shop	Any location where metal, wood, plastic or other material is cut, drilled, shaped or otherwise transformed using power-driven machine tools or equipment. Example tools and equipment include but are not limited to: drill press, lathe, band saw, table saw, mill, grinder, buffer, shear, metal punch, jointer, portable power tools, swing arm saw, radial arm saw, planer, slitter, roll-form machine, cold header, multislide machines, drum sanders, belt sanders, veneer cutters, splicers, and alligator shears.
Machine Shop Responsible Person (Responsible Person)	An employee who is empowered to develop, implement, and enforce departmental policy and administrative controls for a

TERM	DEFINITION
	machine shop. These controls are intended to ensure the safety of those using the machine shop equipment.
Machine Shop Monitor (Monitor)	An employee designated by the Responsible Person to enforce unit-specific machine shop policy and administrative controls for a machine shop. Job duties include training, designation of machine shop safety Monitors and oversight of equipment/users.
Non-Employee	An individual who does not receive any monetary payment from the University of Michigan. An example would include undergraduate students who are enrolled in classes but not hired as temporary staff.
Point of Operation	Means that point at which cutting, shaping, working, assembly or forming is accomplished upon the stock.