



Department of Environmental Health and Safety & Emergency Management

Subject: Machine Shop Safety for Academic Departments

Date: August 2013

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SUMMARY: In an academic research environment, machine shops pose a unique set of challenges in terms of risks to users and administrators. The purpose of this Machine Shop Safety for Academic Departments Guideline is to provide guidance to all employees and students at the University of Michigan – Dearborn who work with machining tools and equipment in order to ensure a safe and productive work environment.

SCOPE: The Machine Shop Safety for Academic Departments Guideline 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.

REFERENCE

REGULATIONS: MIOSHA General Industry:

- [Part 1.](#) General Provisions
- [Part 1A.](#) Abrasive Wheels
- [Part 7.](#) Guards for Power Transmission
- [Part 11.](#) Polishing, Buffing and Abrading
- [Part 12.](#) Welding and Cutting
- [Part 26.](#) Metalworking Machinery
- [Part 27.](#) Woodworking Machinery
- [Part 33.](#) Personal Protective Equipment
- [Part 38.](#) Hand and Portable Powered Tools

DEFINITIONS: *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 general machine shop safety training and specific machine tool and equipment training by the designated Machine Shop Safety Administrator or other designated trainer, 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 Training section of the guideline. Training must be documented and maintained on file by the Responsible Person and should be available upon request by EHSEM.



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Buddy System – This is a system designed to protect the machine tool user in case of injury. During off-hours when the machine shop is vacant, a “buddy” would be present so that, in the event of an injury, emergency assistance is not delayed.

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.

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 – A facility which may contain at least one of the following pieces of equipment: drill press, lathe, band saw, table saw, mill, grinder, buffer, shear, metal punch, jointer, portable power tools, swing arm saw, radial arm saw, planer, sifter, 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 machine shop. These controls are intended to ensure the safety of those using the machine shop equipment.

Machine Shop 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.

Metalworking Machinery – A machine that removes, forms, works or shapes metal or is used to assemble parts.

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 employees.



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RESPONSIBILITY: 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 Environmental Health and Safety & Emergency Management (EHSEM) 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 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 EHSEM's online **Machine Shop Responsible Person Training Program** and ensure that all designated Monitors complete the training as well.

<https://www.umd.umich.edu/index.php?id=696814>



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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 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 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 preventative maintenance performed.

Develop a Lock-out/Tag-out procedure for all equipment as needed and follow the procedures prior to servicing or repairing any piece of machinery or equipment. Refer to EHSEM’s [Lock-out/Tag-out Guideline](#).

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 and manuals for each piece of equipment, as appropriate.

Act as a safety liaison between the individual department and EHSEM with the implementation of this Guideline and all other aspects of machine shops safety.

Establish allowable material use specific for the type of machine, application and environment.

Machine Shop Monitors

Enforce unit-specific machine shop policy and administrative controls for a machine shop as designated by the Responsible Person.

Complete EHSEM’s online **Machine Shop Responsible Person Training Program** and ensure that all designated Monitors complete the training as well. <https://www.umd.umich.edu/index.php?id=696814>



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Provide machine tool user training and maintain documentation of training as necessary.

Provide oversight of equipment/authorized machine tool users.

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. Open toed shoes, loose clothing and hair, and jewelry are permitted.

Report any job related injuries or illnesses, questions on health and safety, or any unsafe or unhealthy working conditions to their supervisor and/or Responsible Person.

Individuals will be classified as “Authorized Machine Tool Users” upon completion of all applicable equipment, tool, and safety training and documents departmental training.

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 such as safety signage or other postings.



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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.

EHSEM

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 EHSEM Guidelines upon request.

Provide technical support on all aspects of this Guideline.

Review and revise the Machine Shop Safety for Academic Departments Guideline, as needed.

Conduct an incident investigation when appropriate.

PROCEDURES:

A. Unit-Specific Machine Shop Safety Policy Development

1. 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. 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 ([Appendix A](#)) that can be modified to the specific shop's requirements.
2. An Academic Machine Shop Equipment Classification Matrix ([Appendix B](#)) can be used as general guidance for development of the unit specific shop policy. This can be implemented in a manner



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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.

B. Training

1. Complete EHSEM's online **Machine Shop Responsible Person Training Program** and ensure that all designated Monitors complete the training as well.
<https://www.umd.umich.edu/index.php?id=696814>
2. Only authorized machine tool users as defined by this Guideline are permitted to operate machining tools in UM-Dearborn facilities.
3. Training of authorized machine tool users shall be performed by the Responsible Person or Monitor who has thorough knowledge and experience of how individual machining tools and equipment are operated, the safety hazards associated with those machining tools and equipment, and specific actions to take in case of an emergency.
4. All users of a machine shop should attend "Basic machine shop safety training" developed and provided by the Responsible Person/Monitor for a specific shop. The training should include the following topics at a minimum: Unit-Specific Machine Shop Policy, use of personal protective equipment (PPE), applicable prohibitions, e.g., loose clothing, hair, gloves and jewelry, etc. guard use/positioning, machining and bit maintenance, as well as hand tool and facility safety. Machine shop general safety rules and equipment specific guidelines ([Appendix C](#)) should also be included in the basic training program.

Length and type of training for specific machines shall be determined by the designated Responsible Person or Monitor as delineated in the site shop policy per the Classification System Matrix. Shop equipment will require Tool Specific Training which should include instruction and hands-on demonstration of the following:



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- 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.

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.

5. 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 ([Appendix D](#)) 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.
6. This training information shall be posted in the designated machine shop, other machine tool user area, or maintained in a central location.
7. 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



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identification will be used to distinguish between authorized users and those who have not been authorized.

8. 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 EHSEM determines that it is necessary.
9. 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 the area.

C. Shop Access

1. 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.
2. 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.
3. 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.
4. Departments are strongly encouraged to limit after-hours usage of power equipment after midnight due to increased fatigue factors associated with late night working.



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D. Shop Inspections

1. 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. To aid in the inspection process, a machine shop safety checklist is included in [Appendix E](#).
2. All machine tools and equipment that are in violation of applicable safety standards, EHSEM Guidelines or unsafe in any manner shall be removed from service and locked out until properly repaired.
3. Documentation of these inspections shall be maintained by the department and be made available to EHSEM upon request.

E. Machine Tool and Equipment Servicing

1. 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.
2. The Lock-out/Tag-out procedure shall be formulated in compliance with the EHSEM Guideline, [Lock-out/Tag-out - Control of Hazardous Energy Sources](#).

F. Machine Shop Safety Signage and Postings

1. 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](#).
2. Consideration should also be given to using signs & labels based on the American National Standards Institute's (ANSI) [Z535.4 Standard](#)



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[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.

G. Project Review

1. Another element to consider incorporating into a shop's safety program is the use of a Project Review Form ([Appendix E](#)). This form can be used by shop's Responsible Persons and Monitors to review and sign off on student'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.

RELATED DOCUMENTS:

EHSEM [Lock-out/Tag-out Guideline](#)
EHSEM [Personal Protective Equipment Guideline](#)
[Work Connections Illness/Injury Report Form](#)
[University of Michigan Standard Practice Guide \(SPG 605.1, 605.2\)](#)
[Hand Tools Institute, "Guide to Hand Tools" manual](#)

TECHNICAL SUPPORT:

All reference guidelines, regulations, and other documents are available through EHSEM (3-4914) or on the EHSEM website: www.umd.umich.edu/ehsem

ATTACHEMENTS: [Appendix A](#) – Academic Machine Shop Safety Policy Template
[Appendix B](#) – Classification Matrix for Academic Machine Shop Equipment
[Appendix C](#) – Machine Shop Safety General Rules and Specific Machine Safety Guidelines
[Appendix D](#) – Machine Shop Usage Agreement and Training Documentation Form
[Appendix E](#) – Self Inspection Checklist Survey
[Appendix F](#) – Project Review Form

Appendix A

Academic Machine Shop Safety Policy Template

(Contact EHSEM for Microsoft Word Version for editing)

This policy template should be customized for each shop to detail specific procedures for shop training, access, oversight requirements, project review and after-hours access (if allowed). Refer to the Classification Matrix for Machine Shop Equipment for guidance. This matrix can also be customized by the shop for the specific equipment available and included as part of the shop policy.

University of Michigan - Dearborn

Academic Machine Shop Safety Policy

IN AN EMERGENCY: CALL 9-1-1 (campus phone will connect directly to UM-Dearborn DPS)

SHOP LOCATION:

RESPONSIBLE PERSON:

CONTACT NUMBER:

SHOP HOURS:

AFTER-HOURS ACCESS ALLOWED?

SIGN-IN BOOK LOCATION:

Following a few, basic, safety practices can ensure a safe, productive, and enjoyable machine shop experience. The U-M student machine shops provide classes that instruct basic machine tool operation and more importantly, basic safety procedures for personnel at all skill levels. Most safety violations are related to PROPER ATTIRE or WORKING ALONE.

**** ACCESS WILL BE DENIED IF PROPER SAFETY PRACTICES ARE NOT FOLLOWED. ****

TOP 3 TENETS OF SHOP SAFETY

Working safely in a machine shop means that you understand 3 things:

- a. You will **NEVER WORK ALONE**.
- b. The basic safety principles of proper shop attire.
- c. The basics of operating the machinery, apparatus or hand tool techniques.

ACCESS TO STUDENT MACHINE SHOP

ACCESS WILL ONLY BE GRANTED WHEN THESE CONDITIONS HAVE BEEN MET:

- a. Successfully complete the "Basics of Machine Shop Safety" class.
- b. Receive tool specific training on the equipment you need to use.
- c. Demonstrate to the Responsible Person/Monitor that you understand the basics of shop safety, and safe equipment operation for certain pieces of equipment as designated by the Shop Safety Policy.

If after-hours use is allowed by the Responsible Person then you MUST sign-in (**with a buddy**) when using this shop after hours. **A minimum of two people must be present in the shop at ALL times.** Only specific equipment will be able to be used without the presence of the Responsible Person/Monitor.

PROPER SHOP ATTIRE

REQUIRED

1. Safety Glasses with Side Shields (both must be ANSI Z87.1 approved)
 - a. All operators and visitors must wear safety glasses while equipment is operational.
 - b. Safety glasses will be provided at the entrance of the shop for use while working in the shop.
 - c. If you choose to purchase your own safety glasses, they are available from most hardware/home improvement stores or on safety supply websites such as Fisher Scientific. Remember, they must be ANSI Z87.1 approved.
 - d. Employees are eligible for prescription safety eyewear through EHSEM. Contact your Supervisor or Responsible Person to request through EHSEM.
2. Long Pants
3. Closed-toe Shoes
 - a. Sandals with socks are not considered closed toe shoes.
4. No loose-fitting, baggy clothing or gloves that can entangle in rotating machinery.
5. Long, loose hairstyles must be restrained in a cap, bonnet or other appropriate manner to no longer than chin-length. Bangs must also be restrained tight to the forehead.
6. Facial hair that might become entangled in rotating equipment must be securely restrained.
7. Remove or secure any jewelry item that may be caught in moving/rotating machinery.
8. Neckwear is not permitted.

RECOMMENDED

1. Apron
2. Hearing Protection (EHSEM can perform noise surveys upon request).
3. Respiratory Protection
 - a. Individuals performing some grinding or sanding operations in the machine shop may choose to wear a dust mask. The material's SDS should be reviewed and the PPE recommendations taken into consideration when making this decision. You can also consult the shop administrator or EHSEM for guidance. Employees must participate in the EHSEM Respiratory Protection Program.

EMERGENCY PROCEDURES

- To contact UM-Dearborn Public Safety, call 9-1-1 from a campus phone or (313)593-5333 from a cell phone.
- Familiarize yourself with evacuation routes in the event of fire, or other building emergency.
- Familiarize yourself with safe shelter procedures in the event of severe weather.

- Review the UM-Dearborn Emergency Response Guide.
- Know the location of emergency eyewash/showers, fire extinguishers, first aid kit, fire alarm pull stations, AED, etc.

ACCIDENT/INJURY REPORTING

When an employee or student is injured in the workplace, the following procedure should be followed. If the employee or student is in need of emergency medical attention, call **9-1-1** immediately.

Employee/Student:

- Report the incident to your supervisor and Shop personnel immediately.

Supervisor:

- Complete the [Work Connections Injury/Illness Report Form](#) and fax immediately to Business Affairs at (313) 593-5111.
- If the employee requires medical treatment, they should be referred to one of the University's designated treatment facilities.
- Send a copy of the form with the employee as authorization for medical treatment.

TREATMENT FACILITIES

Midwest Medical Center, P.C./Metropolitan Airport Office Center – Romulus

Mon-Fri 7:00 am – 6:00 pm

9301 Middlebelt Rd, Romulus MI 48174

Phone: (734)941-1000 Fax: (734)941-9836

Midwest Medical Center, P.C./Dearborn Center

After Hours – 24 hours 7 days a week

4700 Schaefer, Dearborn MI 48126

Phone: (313)581-6009 Fax: (313)581-4316

http://www.umd.umich.edu/fileadmin/template/businessaffairs/images/Midwest_Medical_Center_map.pdf

Safety is the responsibility of everyone involved

... from project conception to project completion.

Appendix B - Classification Matrix for Academic Machine Shop Equipment

	<p>Low Power hand/small bench tools (2-4 amp @120V, < 9V cordless)</p>	<p>Medium Power tools (¼ to ½ hp) (<10 amp @ 120 V, 14-18 V cordless) Specialized NC- computer tools</p>	<p>High Power portable and small bench tools (> ½ hp) (10-15 amps @120V, 24-36 V portable, pneumatics, hydraulics)</p>	<p>Light industrial tools (typically benchtop, < ½ hp, pneumatics, hydraulics)</p>	<p>Large Industrial Tools (manual and NC- controlled)</p>
	<ul style="list-style-type: none"> - Dremel tools - Cordless drills under 18V - Palm sanders - Soldering irons/guns - Heat guns - Hot melt glue guns - Sewing machines - 3D printers 	<ul style="list-style-type: none"> - Jig saw - 3/8" hand drill - Corded devices < ½ hp - 18V-24V cordless drills - Laser cutters/engravers - Thermal foam cutters 	<ul style="list-style-type: none"> - Circular saw - Belt sander - Framing nailer - ½ hp geared drill - Reciprocating saw - >18V cordless tools - Chop/miter saws - Routers - Mini-lathe - Angle grinders - Printing presses 	<ul style="list-style-type: none"> - Small bandsaw - Small drill press - Small/benchtop milling machines - Small/benchtop lathes - Belt/disc sanders - Horizontal saw - Scroll saw - Planer, jointer - Bench grinder - SawStop-style tablesaw 	<ul style="list-style-type: none"> - Full-sized milling machine - Full-sized metal lathe - Table Saw (non –Saw Stop) - Radial arm saw - Large drill press - Large band saw - Surface grinder - Large jointer/planer - Shaper/moulder - Power shear - CNC Mill
	<ul style="list-style-type: none"> - In approved areas with permission of Responsible Person/Monitor - Buddy system 	<ul style="list-style-type: none"> - With permission of Responsible Person/Monitor - Buddy system 	<p>Only when Responsible Person/Monitor is present. Documented project safety review should be completed.</p>	<p>Only when Responsible Person/Monitor is present. Documented project safety review should be completed</p>	<p>Only when Responsible Person/Monitor is present. Documented project safety review should be completed.</p>
	Locked Cabinet	Locked Cabinet	Locked cabinet	Tool Power Lockout	Tool Power Lockout
Oversight Requirements	Oversight by individual with tool experience	Oversight by individual with tool experience	Oversight by individual with tool experience	- Oversight by individual with extensive tool experience.	- Oversight by individual with (documented) professional-level experience
User Training Requirements	<ul style="list-style-type: none"> - Basic Machine Shop Safety and individual tools. - Training must be documented. 	<ul style="list-style-type: none"> - Basic Machine Shop Safety and individual tools. - Training must be documented. 	<ul style="list-style-type: none"> - Basic machine shop safety - Tool Specific Training - Demonstrated proficiency - Training must be documented for individual tool. 	<ul style="list-style-type: none"> - Basic Machine Shop Safety - Tool specific instruction - Hands-on use training and experience. - Demonstrated Proficiency - Training must be documented for individual tool. 	<ul style="list-style-type: none"> - Basic Machine Shop Safety - Tool specific instruction - Extended Hands-on use training and experience. - Demonstrated Proficiency - Training must be documented for individual tool.

Appendix C

Machine Shop Safety General Rules

and

Specific Machine Safety Guidelines

(Contact EHSEM for editable documents)

Note: The following information is provided as a guide for the minimum safety training that shall be provided to personnel. Additional training on the equipment including review of manual, specific instruction for the specific type of equipment owned, and hands-on instruction/demonstration must also be provided prior to authorizing the use of any of the following machining tools or pieces of equipment.

Machine Shop Safety

GENERAL SHOP DRESS (CLOTHING, ATTIRE, ETC.) RULES

1. Safety glasses with side shields (ANSI Z87.1 approved) must be worn at all times.
2. Rings, watches, bracelets, and large earrings may not be worn in the shop. Necklaces may be worn if securely contained inside the shirt. Remember: remove or secure any item that may be caught in moving/rotating machinery.
3. Long, loose hairstyles must be restrained in a cap, bonnet or other appropriate manner to no longer than chin-length. Bangs must also be restrained tight to the forehead.
4. Facial hair that might become entangled in rotating equipment must be securely restrained.
5. Only close-fitting clothing made of smooth, close-woven fabrics may be worn in the shop. Neckties, sweaters, and bulky shirts may not be worn. Full length pants are required when operating shop equipment that may generate hot or sharp debris.
6. Long sleeves on shirts must be rolled up, and maintained, above the elbows.
7. Leather, closed-toe, shoes should be worn in the shop. Thin fabric shoes, sandals, open-toed shoes, and high-heeled shoes are prohibited.
8. A machinist's apron with quick break-away straps should be worn.

GENERAL SHOP SAFETY RULES

1. **NEVER** operate equipment until you have been given instruction in its operation, and permission to use it, from the shop administrator.
 - a. If you are in doubt about its safe operation ask the shop administrator before proceeding.
2. **NEVER** work alone. (Implement the “buddy” system.)
 - a. If after hours use is allowed by the shop administrator then you **MUST** sign-in with a buddy, i.e., another Authorized User when using this shop after hours. **NO** exceptions. Two people must be present in the shop at ALL times.
3. **NEVER** operate a machine unless you are in complete control of your physical and emotional faculties.
 - a. You may not operate a machine if you are sick, tired, intoxicated/drugged, stressed or angry.
4. **NEVER** use your hands to stop a moving machine part such as a drill press or lathe chuck.
 - a. Always keep hands, and other body parts, a safe distance from moving machine parts, work pieces, and cutters.
5. **NEVER** clean, oil, adjust, or change gears or belt pulleys unless a machine has completely stopped.
 - a. When making repairs or accessory changes, such as changing a lathe chuck, shut-off power to the machine at its electrical box or pull its power plug so that it cannot be accidentally powered on. Follow EHSEM Guideline, [Lock-out/Tag-out – Control of Hazardous Energy Sources](#).
6. **NEVER** allow more than one person to operate a machine at any time.
7. **NEVER** be distracted by day-dreaming or conversation while running a machine.
8. **NEVER** walk away from a machine that is powered and operational.
9. **NEVER** startle anyone who is operating a machine.
 - a. If it is necessary to get the machine operator’s attention, do so in a careful manner.
10. **NEVER** sit or lean on a machine – keep your hands off unless you are operating it!
 - a. Maintain an upright, well-balanced stance while operating a machine.
11. **NEVER** allow large quantities of chips or debris to accumulate around a work piece.
12. **NEVER** use compressed air guns to clean clothing, hair, or aim at another person.
13. **NEVER** move metal chips with bare hands
 - a. Use a brush, stick, pliers or other mechanical method.
14. **NEVER** attempt to take measurements on a work piece while the machine is running.
15. **NEVER** engage in any form of horseplay, or pranks, in the shop.
16. **NEVER** lay tools on the machines – use carts or workbenches for storage.
17. **NEVER** use damaged hand tools such as a hammer with a loose head or a file without a handle.
18. **NEVER** remove or deactivate guards or other safety devices from machinery and equipment except when necessary for servicing.
19. Use hand tools for their designed purposes only. For example, never use a scribe as a center punch or a file as a hammer.
20. Report defective machinery, equipment (including any safety devices) or hand tools to the shop administrator/monitor.
21. When moving heavy objects, lift with your legs instead of your back. Get help moving something that might be too much for you to handle alone.
22. Keep work areas neat and free from clutter. Clean machines after each use.
23. If you suffer an injury, no matter how slight you may think it is, report it immediately to the shop administrator/monitor.
24. **ALWAYS** wash your hands thoroughly when finishing in the shop, especially before eating or smoking.
25. The use of personal listening devices, e.g., iPods, MP3 players, etc., is prohibited.
26. Turn off power to applicable equipment in the event of power loss to the shop.

LATHE SAFETY GUIDELINES

<http://www.lathes.co.uk/latheparts/index.html> Reference for picture and parts descriptions

1. Must obtain basic shop safety training and equipment specific training before using this tool. Must wear appropriate PPE and follow all shop rules. Refer to the manufacturer's operating manual for all operating procedures.
2. All stock must be properly secured in the lathe chuck or mounted prior to the machining process taking place. Use the correct sized clamp or vise for the stock being machined.
3. Turn the chuck or faceplate by hand to ensure there is no binding or danger of the work striking any part of the lathe.
4. Check to ensure the cutting tool will not run into the chuck or lathe dog. If possible, feed away from the chuck or dogs.
5. Before starting the lathe, ensure the spindle work has the cup center imbedded; tail, stock and tool rests are securely clamped; and there is proper clearance for the rotating stock.
6. Prior to starting the lathe, ensure that small diameter stock does not project too far from the chuck without support from the tail stock center.
7. When using wood, do not mount a split workpiece or one containing knots.
8. When roughing stock, do not force the tool in the work piece or take too big a cut.
9. The operator must always be aware of the direction and speed of the carriage or cross-feed prior to engaging the automatic feed.
10. Never leave the key in the chuck. Do not let go of the key until it is free of the chuck and secured in its proper holding place.
11. Select turning speed carefully. Large diameter stock must be turned at a very low speed. Always use the lowest speed to rough out the stock prior to final machining.
12. The correct speed and feed for the specific material and cutting tool must be used. Stop the machine before making adjustments or measurements.
13. Do not remove metal or wood chips from the table or stock by hand. Use a brush or other tool to properly remove chips or shavings from the table or stock.
14. Never attempt to run the chuck on or off the spindle head by engaging the power.
15. Do not stop the rotation of the chuck by reversing the power to the lathe unless tapping holes.
16. Do not leave tools, bits or excess pieces of stock on the lathe bed.
17. All belts and pulleys must be guarded. If frayed belts or pulleys are observed, the lathe must be taken out of service and the belts or pulleys replaced.
18. Stop the machine immediately if odd noise or excessive vibration occurs.
19. Only properly sharpened drill bits and cutting tools in good condition should be used. Dull drill bits and chipped or broken cutting tools must be removed from service.
20. Never use a file without a handle. If any filing is done on work revolving in the lathe, file left handed to prevent slipping into the chuck.
21. Disconnect the lathe from power source and follow EHSEM Guideline [Lock-out/Tag-out – Control of Hazardous Energy Sources](#) if making repairs or servicing.
22. When an operator has finished working on the lathe, and before leaving the lathe for any reason, the power must be shut off and the machine must come to a complete stop.
23. When an operator observes an unsafe condition with the lathe or stock being worked, the operator must report it immediately to the designated MSSA and the lathe shall be taken out of service until the problem has been corrected.

MILL SAFETY GUIDELINES

1. Must obtain basic shop safety training and equipment specific training before using this tool. Must wear appropriate PPE and follow all shop rules. Refer to the manufacturer's operating manual for all operating procedures.
2. Keep all guards in place while operating the machine.
3. While operating the milling machine allow no one else to touch it.
4. Keep hands away from moving cutting tools.
5. Do not make measurements of the stock while the milling machine is powered.
6. Do not allow large quantities of chips to accumulate around the work piece or machine table. After stopping the machine, use a brush or rag to remove all excess chips from the mill bed and stock.
7. Always use cutters which are sharp and in good condition.
8. Use a rag or Kevlar gloves to handle sharp cutting tools.
9. Cutting tools must be securely fastened in the machine spindle with the proper accessory. Never try to tighten cutting bits or tools by hand.
10. Make sure the cutting tool is clear of the work piece before starting the machine.
11. Make sure cutter is rotating in the proper direction before cutting material.
12. Do not power the machine to tighten or loosen cutting bits or tools.
13. Work pieces and stock must be rigidly fastened to the mill bed with clamps, a vise, or special fixtures.
14. Use appropriate speeds and feeds for the type and size of cutter being used and the material being machined.
15. Always use the proper cutting fluid for the material being cut.
16. Do not place anything on the milling machine table such as wrenches, hammers, or tools.
17. Always stay at the machine while it is running.
18. Use the milling machine spindle brake to stop the spindle after the power has been turned off.
19. Before cleaning the mill, remove cutting tools from the spindle to avoid cutting yourself.
20. Follow EHSEM Guideline [Lock-out/Tag-out – Control of Hazardous Energy Sources](#) if making repairs or servicing.

DRILL PRESS SAFETY GUIDELINES

1. Must obtain basic shop safety training and equipment specific training before using this tool. Must wear appropriate PPE and follow all shop rules. Refer to the manufacturer's operating manual for all operating procedures.
2. Ensure all safety shields and guards are in place.
3. Know the location of start and stop switches or buttons and keep the drill press table free of tools and other materials.
4. Use only properly sharpened drill bits, sockets and chucks in good condition. Remove dull drill bits, battered tangs, or sockets from service.
5. Do not remove by hand metal or wood chips from the table or stock. Use brushes or other tools to properly remove chips. **Never clean a machine while it is in motion.**
6. Do not place tapered shank tools such as large diameter drills or tapered shank reamers in a drill chuck. Only straight shank tools such as standard drills can be clamped in chucks.
7. Always clean drill shank and/or drill sleeve, and, spindle hole before mounting.
8. Remove taper shank tools from spindle or sleeve with a drill drift and hammer.
9. Do not attempt to oil the machine or make adjustments to the work while the drill press is in motion.
10. Do not insert a drill chuck key into the chuck or loosen the drill chuck until the power is shut off and the machine has come to a complete stop.
11. All belts and pulleys must be guarded; if frayed belts or pulleys are observed, the drill press must be taken out of service and the belts or pulleys must be replaced.
12. All stock must be properly secured with a vise or clamps prior to a machining process.
13. If the stock slips in the vise or clamp, the operator must not attempt to hold the work with his/her hand or try to tighten the vise/clamp while the machine is in motion. Shutdown the power to the machine prior to re-tightening the loose stock.
14. Use the correct speed and drill for the type of stock being machined.
15. Use the correctly ground bit for the stock being machined. Bits with feed screw or extremely long bits should not be used.
16. The drill bit should be mounted the full depth and in the center of the chuck.
17. Position the table and adjust the feed stroke to eliminate the possibility of the bit striking the table.
18. Use the proper cutting fluid for the materials being drilled. Ask a shop monitor about the appropriate fluid for the material you are machining.
19. Plexiglas and other brittle plastics may be difficult to drill. Ask shop administrator/monitor for advice on drill and coolant selection when drilling these materials.
20. Feed the bit smoothly into the work. If the hole being drilled is deep, withdraw the bit frequently to remove shaving on the bit.
21. If the bit binds, stop the machine and turn the spindle backwards by hand to release the bit.
22. Ease up on drilling pressure as the drill starts to break through the bottom of the material.
23. Do not drill with too much pressure.
24. Always try to support part on parallels or a backing board when drilling through material.
25. Never attempt to remove a broken drill with a center punch or hammer.
26. Never try to stop the spindle by hand. Let it stop of its own accord after turning power off.
27. When an operator has finished working on the drill press, and before leaving the drill press for any reason, the power must be shut off and the machine must come to a complete stop.
28. When an operator observes an unsafe condition on the drill press, or stock that is being worked on, they must report it immediately to the Responsible Person and the press will be taken out of service until the problem has been corrected.

BENCH/PEDESTAL GRINDER SAFETY GUIDELINES

1. Must obtain basic shop safety training and equipment specific training before using this tool. Must wear appropriate PPE and follow all shop rules. Refer to the manufacturer's operating manual for all operating procedures.
2. Abrasive wheel machinery should not be operated without the appropriate guards in place.
3. Inspect the wheels before turning on the power. Do not use wheels that are chipped or cracked.
4. The machine shop safety administrator/monitor should mount and balance new wheels.
5. Never use a wheel that has been dropped or received a heavy blow, even though there may be no apparent damage. It may be weakened or unbalanced enough to fly apart upon startup.
6. Stand to one side of the wheel when turning on the power. Damaged wheels will sometimes fly apart, and this is most likely to happen upon startup.
7. Prior to adjusting the work rest or tang, unplug the power to the grinder from the wall receptacle. If the grinder is hardwired into a box, follow EHSEM Guideline [Lock-out/Tag-out – Control of Hazardous Energy Sources](#).
8. Keep the tool rest as close to the grinding wheel as possible without touching it. The tool rest must be minimally within 1/8 of an inch of the grinding wheel.
9. Prior to starting the grinder, ensure the tang at the top of the wheel opening is located within 1/4 inch of the wheel.
10. Before starting the grinder, make absolutely sure that the grinding wheel clears the top of the work piece. Approach the work piece manually to ensure this. Do not feed the table in automatic grind mode.
11. Be alert and cautious when a grinding operation requires locating fingers close to the wheel.
12. Feed the stock into the wheel with light to medium pressure. Do not force the piece.
13. Do not use the side of the grinding wheel to shape stock.
14. Stand erect in front of the grinder with both legs straight and slightly apart. Avoid stooping or leaning into the machine.
15. Keep the grinding wheel dressed. Dressing a small amount frequently is better than having to dress a lot later and will allow the wheel to cut faster, cooler and with a better surface finish. Dressing is cleaning and smoothing the surface of the grinding wheel.
16. Hold work securely while grinding, use the tool rest to support the work when off-hand grinding on bench or pedestal grinders.
17. Do not grind aluminum. Aluminum dust is explosive. Check with shop staff for safety instructions if aluminum must be ground.
18. If a magnetic chuck is being used on the surface grinder, make sure it is holding the work securely before starting to grind.
19. Report to the shop supervisor immediately any cracked, broken or otherwise defective wheels.

PLANER SAFETY GUIDELINES

1. Must obtain basic shop safety training and equipment specific training before using this tool. Must wear appropriate PPE and follow all shop rules. Refer to the manufacturer's operating manual for all operating procedures.
2. Inspect cutter head for sharpness.
3. Do not use the planer if the cutter head is dull or if there is visible rust on it.
4. Check stock for loose knots, nails and other defects before planing.
5. Remove shavings only after the cutter head has come to a complete stop after turning off the power.
6. Keep hands away from the top surface of the board near the feed rolls.
7. When planing bowed stock, always turn the concave side of the stock toward the table and cut with the grain.
8. Disconnect and follow EHSEM Guideline [Lock-out/Tag-out – Control of Hazardous Energy Sources](#) if servicing is required.

BAND SAW SAFETY GUIDELINES

1. Must obtain basic shop safety training and equipment specific training before using this tool. Must wear appropriate PPE and follow all shop rules. Refer to the manufacturer's operating manual for all operating procedures.
2. Ensure the guard doors are closed and the blade is properly adjusted prior to turning on the machine.
3. Adjust the upper guard assembly to within 1/4 inch of the stock prior to starting the machine. Set the band saw at the appropriate speed for the type of stock being machined.
4. Check to ensure the band saw blade is sharpened.
5. Examine the blade before installing to see if it is cracked, do not install a cracked blade.
6. Use the proper pitch blade for the thickness of the material to be cut. There should be at least 2 teeth in the material when cutting aluminum and three teeth when cutting steel.
7. Check to ensure the band saw is correct for the type of stock and correct speed being used.
8. Allow the saw to reach full set speed prior to cutting stock.
9. Do not force stock into the saw blade. Let the speed of the blade cut stock appropriately.
10. Make "release" cuts before cutting long curves.
11. Plan saw cuts to avoid backing out of curves in the stock.
12. Never push a piece of stock with hands in front of the saw blade. Use a push stick. Keep hands at a safe distance on either side of the stock being machined.
13. Use a push stick or board to push small or irregular sized stock. Small work pieces can also be secured with a tabletop vise or clamp.
14. All round stock must be secured in a tabletop vise or clamp prior to starting the cut.
15. Hold the stock flat on the table prior to starting the cut.
16. If the saw blade binds on a piece of stock, turn the saw off and wait until it comes to a complete stop before attempting to remove the blade from the stock.
17. If the band breaks, immediately shut off the power and stand clear until the machine has stopped.
18. Follow EHSEM Guideline [Lock-out/Tag-out – Control of Hazardous Energy Sources](#) if making repairs or servicing.

TABLE SAW SAFETY GUIDELINES

1. Must obtain basic shop safety training and equipment specific training before using this tool. Must wear appropriate PPE and follow all shop rules. Refer to the manufacturer's operating manual for all operating procedures.
2. Inspect the blade before using it to make sure it is the proper blade and is sharp and free from cracks.
3. Appropriate guards must be in place at all times. Never remove a guard.
4. Use the proper blade for the material and type of cut. Do not use a rip blade for cross cutting or a crosscut blade for rip sawing. Only use a plywood blade on plywood.
5. The circular blade of the table saw should be set to 1/8 inch above the work.
6. Stand to one side, never directly in line with the work being fed through the saw.
7. Never allow your fingers to get near the blade when sawing. Use a push stick to rip narrow pieces of stock.
8. Do not use a push stick to remove scrap. Shut off the machine and wait until the blade stops before clearing scrap.
9. If the material to cut is too large, get assistance in supporting the material as it is fed through. Never try this alone.
10. Never reach over the saw to get something on the other side.
11. When shutting off power, never attempt to stop the saw quickly by shoving anything against the blade. Make sure the saw is stopped before leaving it.
12. Never make any adjustments to the saw while it is running. Turn off the power and make sure the saw is completely stopped before attempting to adjust it.
13. Do not allow material to collect on or around the table. Sweep up sawdust and material scraps regularly and before leaving area at the end of your usage of the saw.
14. Follow EHSEM Guideline [Lock-out/Tag-out – Control of Hazardous Energy Sources](#) if making repairs or servicing.

Appendix D



Academic Machine Shop Usage Agreement and Training Documentation Form

Name (print)	UM ID #:
Email Address	Department:

1. I have received basic machine shop safety training.
2. I have read and I understand the machine shop safety rules and policies and procedures established as they apply to my work in the shop or designated area.
3. I agree to abide by all published and posted rules and accept personal responsibility for my work in the machine shop or designated area that I have been authorized to work within.
4. I understand that I must receive training on the machines, tools or equipment that I need to use within the machine shop (or designated area) and that it will be documented on the reverse side of this form.
5. I will not attempt to use any machine, tool, or equipment that I do not have training documentation or permission to use.
6. I understand the shop access rules, monitor/supervision requirements and machine shop hours.
7. I understand that safety glasses are required and what attire is appropriate for machine shop use.
8. I will clean and maintain all equipment, floors and benches that I use.
9. I will promptly notify the machine shop responsible person or monitor if I find any equipment or tools that need repair or that are not functioning properly.
10. I understand that my failure to follow established rules may result in my loss of privileges in the shop/designated area.

Signature	Date
Responsible Person/Monitor Signature	Date

Appendix E

CHECKLISTS

1. [General Machine Shop Safety Checklist](#) (page 2)
2. [Pedestal/Bench Grinder](#) (*OSHA website*)

MACHINE SHOP EQUIPMENT INSPECTION SURVEYS*

1. [Drill Press](#)
2. [Pedestal/Bench Grinder](#)
3. [Wood Lathe](#)
4. [Jointer](#)
5. [Metal Lathe](#)
6. [Vertical Mill](#)
7. [Wood Planer](#)
8. [Vertical Belt Sander](#)
9. [Vertical Spindle Sander](#)
10. [Belt/Disc Sander](#)
11. [Vertical Band Saw](#)
12. [Horizontal Band Saw](#)
13. [Abrasive Chop Saw](#)
14. [Panel Saw](#)
15. [Radial Arm Saw](#)
16. [Scroll Saw](#)
17. [Table Saw](#)

* These **Equipment Inspection Surveys** were developed by [Lovegreen Risk Management, LLC](#).

GENERAL MACHINE SHOP SAFETY CHECKLIST

Room _____ Building _____

Date _____

Supervisor _____

Inspected by _____

EMERGENCY	YES	NO	N/A	COMMENTS
Emergency Phone Numbers posted near a phone				
Exits and exit paths are free of obstruction				
First aid kits available and stocked				
Fire extinguishers accessible and inspected monthly				
GENERAL SAFETY	YES	NO	N/A	COMMENTS
Administrative responsibility for shop safety has been clearly defined.				
Machine users have completed "Basic Machine Shop Safety" and specific training on individual tools and training is documented.				
Where necessary, lock-out/tag-out procedures are documented for each piece of equipment, and training has been provided & documented				
Protective (ANSI Z87.1 approved) eyewear worn at all times in areas where equipment is operating				
Safety training documented and posted or maintained in a central location				
Student access limited to regular hours of operation				
After-hours access is prohibited, unless prior, written approval obtained.				
Mandatory student "buddy system" enforced at all times				
Long, loose hair must be contained in a scarf, cap or other appropriate fashion; long facial hair properly restrained				
Loose clothing, loose neck wear and jewelry not being worn while operating, or in proximity to, machinery				
Acceptable shoes are worn by equipment users				
Long shirt sleeves must be rolled up snugly above the elbows				
Compressed air reduced to 30 psi and not used to clean person or clothes				
Personal listening devices are prohibited.				

GENERAL MACHINE SAFETY	YES	NO	NA	COMMENTS
Machinery installed to prevent unintentional movement or tipping				
A brush is available to remove stock shavings and chips				
Materials, scrap, and debris properly contained				
Machinery located so that operators do not stand in an aisle or interfere with the operation of other equipment				
Powered electrical equipment has an on-off switch				
Actuating controls are guarded or located to prevent accidental actuation, and precautions have been taken to prevent a machine from automatically restarting upon the restoration of power after a power failure				
A red emergency stop device is provided where the machine workstation is remotely located from the machine controls				
GENERAL MACHINE SAFETY	YES	NO	NA	COMMENTS
Actuation of the controls requires continuous depressions during the hazardous portion of the machine cycle where the machine workstation is remotely located from the machine controls				
ELECTRICAL SAFETY	YES	NO	NA	COMMENTS
All electrical service cords are in good condition				
Electrically powered machines are grounded				
All electrical receptacles within 6' of water source have GFCI protection				
Extension cords are not used as a permanent source of electricity				
HOUSEKEEPING/HAZARD COMMUNICATION	YES	NO	NA	COMMENTS
Storage areas are free of accumulations of materials that constitute a hazard from fire, explosion or pest harborage				
Working dust collection system to minimize materials & debris around cutting, drilling & milling equipment				
All safety cans are red in color				
All emergency stop devices on machines (except cables) are red in color				
Physical hazards are marked with yellow or yellow with black stripes				
Unobstructed 3-foot aisle maintained between machines				

Chemicals are properly labeled, and stored in designated area(s)				
Appropriate safety signs, labels, tags & other postings are displayed in applicable areas				
SHEET METAL SHEAR	YES	NO	NA	COMMENTS
Blade and hold down clamp guarded by a fixed barrier or automatic clamps set within 1/4" of the table/stock				
Pusher stick being used prior to shearing small pieces of stock				
Point of operation guard is in place				
Employee tending the backside is separated from the moving parts				
BUFFER	YES	NO	NA	COMMENTS
Guard positioned 180 degrees from the wheel				
Adjustable deflector, of at least 16 gauge metal or equal material, 1/4" from the wheel face				
CUT-OFF SAW (Horizontal/Vertical)	YES	NO	NA	COMMENTS
Saw blade totally enclosed & guided at the point of operation				
TABLE SAW	YES	NO	NA	COMMENTS
Appropriate anti-kickback device with a spreader/splitter				
Blade/hood guard over the blade that maintains contact with cutting stock				
SHEET METAL BRAKE	YES	NO	NA	COMMENTS
Point of operation guard is in place				
WELDING	YES	NO	NA	COMMENTS
Proper shielding and eye protection used by worker performing welding				
Welding area is isolated from other sections of the shop				
Fire hazards and combustibles are removed from the welding area and tanks or vessels purged before welding				
Appropriate portable fire extinguisher for use by trained individual				
Welding cables/tubing free from damage (cuts, burns, exposed conduit)				
Welding gas cylinders are free from damage (checked for leaks) & secured				
Compressed gas cylinders are stored properly				
Adequate ventilation is evident/in place				
Workers adjacent to area are protected by flameproof shield (If not, welding goggles needed)				

Approved protective equipment to prevent backflow of oxygen or passage of a flashback into a fuel gas supply				
Color coded hoses for oxygen (green) and fuel gases (red)				

Appendix F



Academic Machine Shop Project Review Form

Name (print)	UM ID #:
Email Address	Department:

Project Outline and Safety Review – Include project description, anticipated machines, tools, materials, etc., potential safety concerns, and safety measures to be taken to address the concerns.

Parties below should sign document after thorough review of project has been completed and safety concerns have been expressed and adequately addressed. Any significant changes to the project should go through additional review after signing.

Signature	Date
Responsible Person/Monitor Signature	Date