



# University of New Haven

## POLICIES AND PROCEDURES

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Machine Shop Safety Policy

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Department of Public Safety

**Responsible Official:**

Associate VP of Public Safety & Administrative Services

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## **1.0 General Policy**

The University of New Haven is committed to providing a safe and healthy work environment for our employees and students. It is the policy of the University of New Haven that machine shops and machine shop equipment be operated in a safe manner by properly trained individuals.

The University of New Haven recognizes hazards that may be encountered while working in the mechanical engineering laboratory. Employees and students are expected to adhere to all elements of this policy as well as the laboratory safety rules while operating all machinery.

### **1.1 Purpose**

The purpose of this policy is to provide employees and students with safety guidelines to be followed while working within the mechanical engineering laboratory located on the first-floor level of the Buckman building room 127 and outline appropriate training guidelines for equipment users. This policy is written to also address compliance in this laboratory area with Occupational Safety and Health Administrations (OSHA) regulations inclusive of machine guarding, lockout/tag out, hand and power tool safety, electrical safety and other machine safety regulations.

### **1.2 Review**

The Associate Vice President of Public Safety & Administrative Services will review and update this Plan whenever necessary or at least annually through ongoing observations of safety compliance within the mechanical engineering laboratory and conversations with teaching staff within this area. Additional reasons for updating this plan include but are not limited to the following:

- Changes in job duties, employee assignments, processes or operations;
- Changes in applicable regulations; or
- The purchase of new equipment within the mechanical engineering laboratory.

All the elements of this Plan are considered University of New Haven policy and may be enforced as such. Failure on the part of the employees and/or students to follow the policies and safety requirements of this Plan may result in disciplinary action.

## **2.0 Responsibilities**

### **2.1 Mechanical Engineering Deans, Department Chairs and Faculty**

- Implement a Mechanical Engineer Laboratory Safety Program.
- Designate and authorize an individual who has thorough knowledge of proper machine operation and safe working procedures as the Associate Laboratory Supervisor.
- Actively support this Policy within the mechanical engineering laboratory.
- Ensure an environment where supervisors, students and other personnel are encouraged to follow this Policy.
- Inform the Associate Vice President of Public Safety & Administrative Services.

### **2.2 Machine Shop Safety Coordinator (MSSC)**

- Manage all activities that impact machine shop safety. Examples of these activities include user training, proper use of personal protective equipment, project set up, removal of unsafe machines from service, posting of appropriate signage at work areas and approval of users in the shop.
- Implement a safety plan or adopt this Policy as a procedure.
- Conduct safety inspections of machining tools, equipment and facilities at a minimum of once a year.
- Train all employees and non-employees on machining tools and equipment use.
- Maintain training documentation as stated.
- Limit students' access to tools and equipment. Students using machining tools and equipment beyond established working hours and during weekends shall be prohibited.
- Assure appropriate personal protective equipment is worn by those using equipment.
- Act as a safety liaison between the mechanical engineering department and the Associate Vice President of Public Safety & Administrative Services with the implementation of this Policy and all other aspects of machine shop safety.
- Establish allowable material use specific for the type of machine, application and environment.

### **2.3 Associate Vice President of Public Safety and Administrative Services**

- Monitor conformance with this Policy, as well as state and federal regulations.
- Through third party contractor, conduct training on this Policy for designated machine shop safety coordinator.

- Through third party contractor, conduct machining equipment and facility inspections upon request.
- Review and revise the Machine Shop Safety Policy, as needed or at least annually with the assistance of the mechanical engineering department.
- Conduct an incident investigation when appropriate.

## **2.4 Machine Users**

- Comply with this Policy and any further recommendations initiated by the MSSC.
- Conduct assigned tasks in a safe manner, wear appropriate personal protective equipment, 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 conditions to the MSSC.
- Individuals will be classified as "Authorized Machine Tool Users" upon completion of training and documented departmental training records. These authorized users will still require supervision while working with these tools.
- Operate only the specific machines, tools and equipment they have been trained to use.
- 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 defective machinery, equipment and hazardous conditions to the MSSC.
- Do not remove guards from machinery and equipment.

## **3.0 Definitions**

*Authorized Machine Tool User* – any individual person who has received both general machine shop safety training and specific machine tool and equipment training by the designated MSSC or other designated trainer, and is thus authorized to access and use the specific machining tools and equipment using established procedures.

*Competent Person* – A person with the knowledge and ability to shut down equipment in use, shut down room power (where possible), and summon medical assistance in the event of an emergency.

*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.

*Machine Shop* – a department designated facility which may contain at least one piece of restricted Machining equipment.

*Machine Shop Safety Coordinator (MSSC)* – an employee who develops and implements administrative controls to ensure the safety of any person operating restricted machining equipment.

*Restricted Machining Equipment* – any of the following fixed (electrically, pneumatically, or hydraulically) powered pieces of equipment: drill press, lathe, band saw, table saw, mill, milling machine, grinder, buffer, shear, metal punch, jointer, swing arm saw, radial arm saw, planer, slitter, roll-form machine, cold header, multi-slide machines, drum sanders, belt sanders, veneer cutters, splicers, alligator shears, and any other fixed powered equipment that must operate without guards.

#### **4.0 Shop Access**

Shop access requires equipment specific training as well as a signed agreement accepting the code of conduct and defining the tools in which the student is authorized to use. The MSSC is the holder of the documents and oversees this portion of the program. The door to the machine shop is locked at all times and access is granted only by the MSSC. Shop access by students and untrained faculty is prohibited on hours that the MSSC is not present.

The mechanical engineering department requires that all that enter the lab space are required to sign-in on the provided sign-in sheet within the designated entrance space of the mechanical engineering laboratory. All shop access and usage require supervision.

#### **5.0 Shop Safety Rules**

Many occupational injuries occur due to unsafe work practices or flawed procedures. Personnel injuries are rare in locations where equipment is maintained in good operating condition and operated correctly. University employees and students must be adequately trained, and all personnel must comply with safety rules and display a committed attitude toward safety. The shop rules listed below are intended to provide a safe environment in which to work. However, if a situation does not appear to be safe, the MSSC must be notified prior to conducting the work. A fundamental responsibility of the MSSC is to develop and establish the procedures to be used, and to enforce the use of those procedures. To be effective, laboratory procedures must be in writing, employees and students must be trained in the use of the procedures and the procedures must be readily available for reference. Shop rules must be prominently displayed and adherence to such rules enforced.

The following general rules apply to the mechanical engineering laboratory at the University of New Haven:

- Laboratory areas must be free of housekeeping hazards and shall be clean and orderly.
- Proper Personal Protective Equipment (PPE) must be used in accordance with the University of New Haven's PPE policy and posted laboratory safety policies.
- Never attempt to operate any machinery or equipment that is unfamiliar.
- Tools and equipment shall not be left unattended while parts are still in motion or machinery is in a "cocked" or mid-cycle status.
- When machines are not in use, the motor controller switch should be left in the "off" position.
- Operators must not wear jewelry, loose-fitting clothing, neckties or other apparel that may become caught in machinery. In addition, no hooded sweatshirts with pull strings are allowed to be worn by machine operators.
- While working at or near exposed rotating machinery with hair of length such that it could become caught in the machinery, a cap, or other restraint, that covers and/or contains the hair must be worn.
- Eye protection must be worn by all who enter the mechanical engineering laboratory.
- Manual adjusting and gauging (callipering) of work must not be performed while a machine tool or machine is in operation.
- Only the proper hand tools should be used. Tools should be kept in their proper location (such as a tool rack or chest).
- Laboratory work procedures must be developed, posted and enforced. Laboratory safety practices do not permit taking chances.
- Power to equipment must be shut off, disconnected, or locked out, while changing blades, drill bits, etc.

## **6.0 Personal Protective Equipment**

Appropriate personal protective equipment for the task at hand is required to be worn by everyone operating machinery in the laboratory as well as those in the immediate area of the equipment being used.

All personal protective equipment should be inspected by the user prior to wearing it and defective or broken personal protective equipment should be removed from service and disposed of.

The following personal protective equipment may be required for operations within the mechanical engineering laboratory.

## **6.1 Eye Protection**

Eye protection that meets the American National Standards Institute (ANSI) Z-87.1-1989 standard must be worn at all times within the mechanical engineering laboratory. Safety glasses are available at the entrance door for occasional users and visitors. Frequent users of these facilities are encouraged to purchase their own safety glasses that meet the above-mentioned standard. For people who wear corrective glasses, eye protection must be of the type that can be worn over glasses. Prescription-ground safety lenses may be substituted if they provide equivalent protection and if side shields are firmly attached to the glasses frame.

Everyone who is welding or viewing welding activities must wear eye protection. Appropriate eye protection will be provided at the welding areas for these activities.

Full-face shields and safety glasses are required for portable hand grinding operations.

## **6.2 Hand and Body Protection**

Ties, rings, watches, bracelets, unbuttoned long sleeves, dresses or other loose clothing cannot be worn while operating machinery. Long pants must be worn when working with any machine tools or equipment, sheet metal or metal scraps and welding equipment.

Long hair must be tied back or covered by a cap while operating all machinery.

Gloves are not to be worn when operating any rotating machinery, however gloves are required for handling sheet metal and sharp tools.

Machine guards provided for a machine must be in place whenever the machine is operated.

Guards or shields removed for maintenance must be replaced before the machine is used.

## **6.3 Respiratory Protection**

Students in shop classes do not need fitted respirators when working within the mechanical engineering laboratory.

Welding must be conducted with good ventilation.

## **6.4 Foot Protection**

Closed-toe shoes are required for all that enter the mechanical engineering laboratory. No exceptions will be made.

## **6.5 Hearing Protection**

Hearing protection shall be used as needed. Prior to installation of new equipment within the laboratory, a hazard analysis shall be completed to assess whether hearing protection is needed.

## **7.0 Machine Safety**



Users of machinery in the mechanical engineering laboratory must be properly trained before using equipment. Untrained staff and students are prohibited from using machinery. Training requirements are outlined in section 11.0 of this policy.

Machine specific safety guidelines can be found in the appendices of this policy.

## **8.0 Machine Guarding**

Factory-installed machine guards shall be in place and not removed during all operation of equipment. Should a machine guard need to be removed for maintenance of a piece of equipment, that equipment shall be unplugged before the guard is removed. The person completing the maintenance shall lockout and tag out all equipment where machine guards have been removed for the purpose of maintenance. Equipment cannot be used until all factory machine guards have been replaced. Appropriate machine guarding use will be monitored by the MSSC.

## **9.0 Hand and Power Tool Safety**

Only properly trained staff and students are permitted to use hand and power tools. Training guidelines are outlined in section 11.0.

When using hand tools, the following safety procedures should be followed:

- Safety glasses are required for all work with the hand tools.
- Inspect tools before use and only use tools that are in good working condition.
- Only use tools for their designated purpose.
- Use the correct size tool for the job.
- Assure that tool is free of any oils or grease before using.
- Always cut away from your body and hands.
- Before setting power tools down, ensure that they have been properly turned off and have completely stopped.

## **10.0 Toxic and Hazardous Substances**

Staff and students are instructed to follow the University Chemical Hygiene Plan when handling and/or disposing of hazardous chemicals.

An eye wash and safety shower are located within the mechanical engineering laboratory to the left of the main egress door. The eye wash station is inspected monthly and the safety shower every six months by the facilities department as outlined in the University's Eye Wash and Safety Shower Policy and Procedures.

## **11.0 Training**

All students working within the mechanical engineering laboratory are required as a pre-requisite to take the *ME001 – Mechanical Engineering Workshop*. This class is a one-hour per week workshop that familiarizes mechanical engineering students with basic practices within a laboratory environment including safety considerations, design planning, layout, fabrication and tolerances.

Those that have not been properly trained and have not attended the ME001 course are not permitted to enter the mechanical engineering laboratory.

The Mechanical Engineering department is tasked with assuring that staff are properly trained on not only the machinery they are operating but also the machinery that students are using.

## Appendix A – Band Saw Safety Guidelines

1. You must attend general and machine specific safety training and wear proper PPE before using a machine.
2. The upper guide and guard should be set as close to the work as possible, at least within 1/4 inches.
3. If the band breaks, immediately shut off the power and stand clear until the machine has stopped.
4. Examine the blade before installing to see if it is cracked, do not install a cracked blade.
5. 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.
6. Check the speed table for the material that you are cutting. Do not run the band saw too fast or the blade will wear out quickly.
7. If the saw stalls in a cut, turn the power off and reverse the blade by hand to free it.
8. If coolant system is present, ensure that coolant tank is full before starting cut. Ensure that cutting fluid is flowing sufficiently.
9. If coolant system is present, especially when cutting composites, ensure that the chips do not clog the coolant circuit. Clean the drain return often to guarantee proper coolant recharge.

## Appendix B – Drill Press Safety Guidelines

1. You must attend general and machine specific safety training and wear proper PPE before using the machine.
2. Run drill at correct RPM for diameter of drill bit and material. Ask a MSSC for the correct RPM.
3. Always hold work to the drill table in a vise or clamp.
4. Use a correct ground drill bit for the material being drilled. The MSSC can help select the correct bit.
5. Use the proper cutting fluid for the material being drilled. Ask a MSSC about the appropriate fluid for the material you are machining.
6. Ease up on drilling pressure as the drill starts to break through the bottom of the material.
7. Never use a dull or cracked drill; inspect the drill before using. If in doubt, check with a MSSC or replace the bit.
8. Do not drill with too much pressure.
9. Always try to support part on parallels or a backing board when drilling through material.
10. **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.
11. Always clean drill shank and/or drill sleeve, and spindle hole before mounting.
12. Remove taper shank tools from spindle or sleeve with a drill drift and hammer.
13. **Never** try to loosen the drill chuck while the power is on.
14. Lower the drill spindle close to the table when releasing the drill chuck or taper shank drill to reduce the chance of damage should they fall onto the table.
15. **Never clean a machine while it is in motion.** Remove chips with a brush, **never** by hand.
16. The drill binds in a hole, stop the machine and turn the spindle backwards by hand to release the bit.
17. When drilling a deep hole withdraw the drill bit frequently to clear chips and lubricate the bit.
18. **Always remove** the drill chuck key or the drill drift from the spindle immediately after using it.
19. Wear safety eye protection while drilling.
20. **Never try to stop the spindle with your hand.** Let the spindle stop of its own accord after turning the power off.
21. Plexiglas and other brittle plastics can be difficult to drill. Ask the MSSC for advice on drill and coolant selection when drilling these materials.

## Appendix C - Grinding Safety Guidelines

1. You must attend general and machine specific safety training and wear proper PPE before using a machine.
2. Special training is required before using the surface grinder. Ask shop staff to demonstrate proper use of this tool.
3. Wear goggles over safety glasses when grinding on bench or pedestal grinders. Abrasive wheel machinery shall not be operated without the appropriate guards in place.
4. Tool rests on bench or pedestal grinders shall be set no more than **1/16 inch** from the wheel.
5. Never use a wheel that has been dropped or received a heavy blow, even though there may be no apparent damage. Such wheels may be weakened or unbalanced enough to fly apart on startup.
6. **Stand to one side when starting a grinding machine.** Damaged wheels will sometimes fly apart, and this is most likely to happen when the machine is being started. Stand to the side so that you will not be in-line with the debris.
7. Do not grind on the side of the wheel unless the wheel is specifically designed for such use.
8. Do not use excessive pressure while grinding. Report to the MSSC immediately any cracked, broken or otherwise defective wheels.
9. Have the MSSC mount and balance new wheels.
10. 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.
11. Hold work securely while grinding, use the tool rest to support the work when off-hand grinding on bench or pedestal grinders.
12. Do not grind aluminum. Aluminum dust is explosive. Check with shop staff for safety instructions if aluminum must be ground.
13. If a magnetic chuck is being used on the surface grinder, make sure it is holding the work securely before starting to grind.
14. 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.

## Appendix D – Lathe Safety Guidelines

1. You must attend general and machine specific safety training and wear proper PPE before using a machine.
2. Make sure that the chuck, drive plate, or faceplate is securely tightened onto the lathe spindle.
3. When removing the chuck, drive plate, or faceplate do not use machine power.
4. When installing the chuck, drive plate, or faceplate do not use machine power.
5. Move the tool bit a safe distance from the collet or chuck when inserting or removing work.
6. Do not run the machine faster than the proper cutting speed – consult a speed and feed table to determine the best speed.
7. When setting up the tool holder place it to the left side of the compound slide to prevent the compound slide from running into the chuck or spindle attachments.
8. Always clamp the tool bit as short as possible in the tool holder to prevent it from breaking or chattering.
9. Always make sure that the tool bit is sharp and has the proper clearance. Ask for assistance when making adjustments.
10. **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.
11. If work is turned between centers, make sure that proper adjustment is made between centers and that the tailstock is locked in place.
12. If work is being turned between centers and expands due to heat generated from cutting, readjust centers to avoid excessive friction.
13. **Do not** grasp or touch chips or turnings with your fingers, remove chips using a blunt instrument. It is safer to turn off the lathe before clearing chips than to leave it running.
14. Set the tool bit on the centerline of your work to prevent work from climbing over tool or cutting above center and dragging.
15. Don't cut work completely through when turning between centers.
16. **Remove chuck key from chuck immediately after using.**
17. Turn chuck or faceplate through by hand before turning on the power to be sure there is no binding or clearance problem.
18. Stop the machine before taking measurements.
19. **Before cleaning** the lathe remove tools from the tool post and tailstock.

## Appendix E – Table Saw Safety Guidelines

1. You must attend general and machine specific safety training and wear proper PPE such as goggles before using machine.
2. You may not operate it without permission from the MSSC.
3. Inspect the blade before using it, to make sure it is the proper blade and is sharp and free from cracks.
4. **Appropriate guards must be in place at all times.** Never remove a guard. Ask MSSC for help if you think the guard is in the way.
5. 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. Do not use a plywood blade for anything but plywood.
6. The circular blade of the table saw should be set to 1/8 inch above the work.
7. Stand to one side, never directly in line with, work being fed through the saw.
8. **Never** allow your fingers to get near the blade when sawing. Use a pusher stick to rip narrow pieces of stock.
9. Do not use a pusher stick to remove scrap. For scrap removal, shut off machine and wait until blade stops, then remove scraps.
10. If the piece of material you are cutting is large, get someone to assist in tailing-off for you. Never try to do it alone. Tailing off refers to supporting a large work piece by supporting it underneath with your hands.
11. If you are tailing-off for someone else let them guide the work through the saw. You should just support the work without influencing the cut.
12. Never reach over the saw to obtain something from the other side.
13. When shutting off the power, never attempt to stop the saw quickly by shoving anything against the blade. Make sure the saw has stopped before leaving it.
14. 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.
15. Do not allow material to be collected on or around the saw table. Sweep up sawdust and material scraps regularly while working to minimize chances of slipping or stumbling.
16. Make sure that you clean up thoroughly around the saw before leaving the area. Failure to do so could be the cause of someone else having an accident.

## Appendix F – Welding Safety Guidelines

1. You must attend general and machine specific safety training and wear proper PPE before starting work.
2. **MSSC approval is required before using any welding equipment.**
3. Welders, assistants, and anyone else in the welding area shall wear glasses or shields of recommended shades during welding operations. Wear the appropriate insulated gloves, aprons, and arm guards when welding.
4. Do not weld while wearing polyester fiber clothing, as it is flammable.
5. The welder is responsible for erecting a screen around the welding area to protect other personnel in the shop from eye injury.
6. Inspect all welding equipment to be used for possible damage, prior to each use.
7. Avoid handling oxygen bottles with greasy hands, gloves or rags as it could result in a fatal explosion.
8. Always strap tanks to a welding cart or a fixed object. Never allow a gas cylinder to be free standing. Replace the safety cap on all cylinders when not in use.
9. Do not arc weld in a wet area.
10. When arc welding, make sure work and/or worktable is properly grounded.
11. Be alert to possible fire hazards. Move the object to be welded to a safe location, or remove all flammable materials from the work area including charging batteries.
12. Never weld in the same area where degreasing or other cleaning operations are performed.
13. Keep suitable fire extinguishing equipment nearby and know how to operate it.
14. Shut off the cylinder valves when the job is completed, release pressure from the regulators by opening the torch valves momentarily and back out regulator adjusting valves. Never leave the torch unattended with pressure in the hoses.
15. Utilize all protective equipment and clothing. Do not arc weld with any part of the body uncovered, the arc light is actinic light (excessive ultraviolet) and will cause burns similar to severe sunburn.
16. Never weld inside drums or enclosed or confined spaces without adequate ventilation, or the use of airline respirators or self-contained breathing apparatus.
17. Check the ventilation system before starting to weld and periodically thereafter to ensure adequate performance. **Welding fumes should not be allowed to get into the rest of the shop's working areas.**
18. Never cut or weld any container that has held explosive or flammable materials. Use prescribed methods for cleaning or flooding.



19. Never use wrenches or tools except those provided or approved by the gas cylinder manufacturer to open valves. Never use a hammer to open or close valves.
20. Abide by any other safety measures required for each particular type of welding.
21. Allow for proper ventilation when brazing or soldering. The fluxes are acidic and toxic.
22. Do not weld on painted, galvanized or greasy, oily metals. Not only can the fumes be toxic, but the welds will not be satisfactory and will fail in use.