

MECHANICAL ENGINEERING

CONSTRUCTION ★ ENERGY ★ MANAGEMENT

EMF Machine Shop 2020 Edition

SAFETY GUIDELINES

This document provides basic guidelines for utilizing the machinery and services available in and by the College of Engineering, UNT EMF machine shop.

Shop Safety Guidelines

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Shop Safety Guidelines

Purpose

The purpose of this document is to set forth policy establishing safe work practices for students, staff and visitors working in the Engineering Manufacturing Facility machine shop. It defines safety guidelines, training requirements and response procedures in case of emergency to minimize injuries and illness when working in a machine shop.

Scope

This policy covers the machine shop maintained and operated by the University of North Texas, ETEC Department .EMF Lab, Discovery Park, Denton, Texas.

Applicability

This policy covers users of the UNT EMF machine shop only, operated under the auspices of the College of Engineering Technology. Machine shops managed by Facilities professional staff are not covered by this policy unless they are also used by students.

Introduction

Machine shops are inherently filled with potential safety hazards. They are also traditionally present in many departments and academic laboratories that are used by the faculty, staff, students, alumni and visitors. Shop equipment and tools are routinely used to complete various projects that, if not handled properly, may result in a serious injury or death. The purpose of this program is to provide a basic overview of the common hazards associated with the use of hand and power tools and equipment that are found in machine shops in laboratories or otherwise, to establish fundamental shop safety rules and to outline the use of safe work practices and use of proper personal protective equipment. Each user of a machine shop is required to attend general shop safety training. However, this training is not a substitute for a machine-specific safety training that should be provided by the Shop Supervisor. Employee awareness of potential hazards combined with following proper safety procedures can reduce accidents and injuries significantly. It is therefore, of vital importance that supervisors become familiar with those sections and standards in this policy that pertain to the operation(s) under their control. The success of this program depends upon the cooperation and support of everyone, students, staff, visitors and Shop Supervisor.

It should be understood that these are minimum standards that apply to all University academic shops present on all campus. More detailed shop specific rules may be developed by Shop Supervisors and Departments that must also be followed.

Procedure

Emergency Contacts:

- Public Safety, 940-565-3000
- Safety Risk Management, 940-565-2109
Richard Pierson, 940-565-2552 After hours 972-704-9860

In case of serious injury or if Public Safety cannot be reached, call 911.
Always notify your Supervisor as soon as possible. You may be required to complete an Accident Form.

Shop Safety Guidelines

General Shop Safety Rules

The UNT EMF Machine Shop has developed these guidelines for those who currently, or might in the future, use power tools and heavy machinery in shops and laboratories. These guidelines DO NOT serve as a replacement for formal training in lab techniques or shop safety. Only trained personnel should use shop equipment after they have been trained by their supervisor. Failure to follow proper precautions can result in serious injury or death.

- 1. Never Use a Machine If You Are NOT Trained – Always Get Training Before Operating Any Machinery.** *You must attend general safety training and specific training on the machine you intend to use. If you are unfamiliar with a particular tool or instrument, do not use it until you are properly trained on its usage.*
- 2. Never Work Alone – Always Use “Buddy System”.** *At least two adults must be in the shop when power tools are being used. You must get permission from your Supervisor for off-hours and weekend work if the shop permits off-hours work.*
- 3. Never Use Machine When Impaired - Be Sober and Smart.** *The use of alcohol or drugs prior to the use of shop machinery is strictly forbidden and is ground for suspension or termination of shop access privileges. Be aware of other situations which may impair your ability to work safely, including illness, tiredness, stress, hurrying, or the use of medication that could make you drowsy.*
- 4. Never Start Work If You Cannot Do the Job Safely - Just Don't Do It.** *There are limits to what can be built in a given shop and in a given time, and how safely you can do it in hurry. If it cannot be done safely don't start it.*
- 5. Never Wear Open Toe Shoes - Use Closed-Toe Shoes in the Shop.** *Sandals, flip-flops or other open-toed shoes are prohibited at all times in machine shops. Tools, chips and fixtures are sharp, and often hot. Shoes will help protect your feet from injury. Flame retardant shoes are recommended when welding.*
- 6. Never Work Without Proper Eye Protection - Always Wear Appropriate Safety Glasses or Goggles When Working or Cleaning Tools.** *The minimum standard for protective eyewear is safety glasses with side-shields; machine users must observe this standard at all times. Eyewear which offers additional protection against splashing or other hazards may be indicated based on a risk assessment of the process or procedure. Prescription glasses with plastic lenses must meet ANSI Standard Z87.1 for safety.*
- 7. Never Work With Loose Hair, Jewelry, Clothing, etc. – Always Remove or Secure Anything That Might Get Caught in Moving Machinery.** *All shop users must secure or remove personal items that may become entangled in a machine. Long hair, necklaces, ties, dangling ID badges, jewelry, loose clothes, watches or rings, may get caught in tools and can drag you along resulting in serious injury or death. Check with supervisor for appropriate attire.*
- 8. Never Bring Hands Close to Sharp Objects – Always Keep Your Hands At a Safe Distance From Sharp Tools.** *Make sure that nothing that you do will cause you to be cut by working too close to a sharp tool or moving machine part. Maintain a safe distance.*
- 9. Violations to any shop safety and machine rules and policies: First violation: Verbal warning, Second Violation: 7-day suspension of shop access, Third Violation: Expulsion and revocation of ALL shop privileges**

Shop Safety Guidelines

- 10. Never Create a Dusty and Smoky Environment - Dust, Chemicals and Smoke Can Be Dangerous to Your Health, so Work in Well-Ventilated Areas, Minimize Contamination and Use Appropriate Protective Equipment (PPE).** *Only use dust or fume-generating machines in their intended areas. Ensure the shop is well ventilated and appropriate PPE is used when working with such machines.*
- 11. Never Be Shy to Seek Help –Always Ask If You’re Unsure About the Safe Operation of a Tool or Any Aspect of a Job – Have Shop Staff Check the Tool or Work with Which You Are Unfamiliar.** *Exercise **common sense** and clarify your tasks and responsibilities before starting work.*
- 12. Never Leave Your Work Area Disorganized – Always Clean Up After Yourself.** *Before you leave your work site all tools must be returned to their storage location, machines must be cleaned and wiped down and the floor swept, as necessary. Leave appropriate time for cleanup at the end of your project.*
- 13. Never Remove Safety Guards – They are Present for Reason.** *Safety guards must never be disabled or removed under any circumstances. You must ensure that safety guards are in place on moving parts before you start working. Follow all appropriate shut-down procedures before working on a machine if the repair requires removal or alteration of guarding.*
- 14. Never Use Gloves While Using Rotating Equipment – Check with Supervisor, if Needed. Remove Them Before Starting Work.** *Gloves can become entangled in rotating machine parts resulting in serious injuries.*
- 15. Never Leave Broken or Damaged Tools or Abnormal Equipment Unreported – Always Inform Your Supervisor to Remove Broken Items from Service for Repair.** *Broken parts or equipment can result in serious injuries and delays. Make sure you tag broken or damaged equipment and inform Shop Supervisor to arrange repair before next use.*
- 16. Never Make Any Adjustments to a Machine When it is in Operation - Always Talk to Your Supervisor for Permission When Adjustment is Needed.** *Make sure you are competent and have permission from your supervisor to affect repairs. Ensure power is off, equipment is properly locked out and safety devices are in place.*

Shop Hours

Regular working hours for the Machine Shop during the week are Monday through Friday, 8 a.m. – 9 p.m., Saturday 9 a.m.- 4 p.m. or by appointment. Access to shops may be limited during scheduled classes, holidays or other reasons. Contact Shop Supervisor for timing and additional information.

During busy periods in the semester the shop may be opened by Shop Supervisor or other staff in the evening and/or on Saturdays . Always check with Shop Supervisor for a change in schedule.

Visitors Use of Shops

No exceptions are made for visitors.

Shop Safety Guidelines

Working Safely with Solvents, Resins and Other Chemicals

1. Learn about the chemicals that you are planning to use before opening a container. Read the instructions and MSDS. Consult Shop Supervisor or College Safety & Radiation Officer if you have any questions.
2. Use water-based cleaners instead of solvents, and other less-hazardous alternative products, wherever possible.
3. Use solvents only in well ventilated areas. Do not work with solvents in a confined or unventilated area. Work in a chemical fume hood whenever possible. Avoid skin contact. Wear proper gloves; consult a manufacturer's glove guide for compatibility. Check with a Shop Supervisor if unsure.
4. Smoking is not permitted in shops or laboratories. Do not smoke or light flames in areas where solvents are used and or stored.
5. Do not use solvents around hot metal surfaces and flames.
6. Do not pour any chemicals down the drain. Waste containers are available when needed. Contact the College Safety & Radiation Officer, Todd Campbell, for assistance.
7. Do not drink alcoholic beverages or take medications containing alcohol before or during working with solvents. Alcohol in the bloodstream sometimes causes synergistic reactions with various solvents that can lead to loss of consciousness, and even possibly, death.
8. Report immediately any ill effects or skin reactions to a Shop Supervisor.
9. Develop and maintain good personal hygiene habits. Remove personal protective equipment and wash thoroughly after contact with solvents.
10. Mix resins in small batches. Fumes from paints, solvents, adhesives, and the abrasive cut-off saw can drift into the shop. Work with staff to minimize these problems.
11. Use of respirators is not permitted without medical clearance and fit testing. Safety & Radiation Officer can provide the necessary paperwork for medical clearance from a health provider and can perform fit testing on a case-by-case basis, as necessary, such as battery charging areas.
12. Report and clean up any manageable spills immediately. For unmanageable spills call Public Safety at ext. 6290. During nights, weekends and holidays call your campus specific Public Safety Office.

Shop Cleaning Guidelines

1. Report missing, broken or damaged tools to shop staff.
2. Turn off power to a machine before cleaning. This will avoid accidentally starting the machine and causing injuries.
3. Remove cutting tools. Take out drill bits, mills and remove lathe tools to reduce the chance of injury. Lower the blade completely on the table saw.
4. Put away all hand tools and other items around the tool so that you don't make them dirtier.
5. Clean chips from the tool, and remove debris from the chip pans. Recycle clean chips where possible.
6. Sweep the floor in the area where you have been working and dispose of it properly.
7. Do not overuse compressed air. Do not blow air into the bearing surfaces, and do not scatter chips. Shop vacuum works better than the air gun.

Shop Safety Guidelines

RESPONSIBILITIES

1. Students

- a. Must use “Buddy System” when working in the shop.
- b. Must complete general shop safety training with the Shop supervisor, having a training certificate on file to arrange machine-specific training before using any machine.
- c. Must observe all shop safety rules in this policy when working in the machine shop.
- d. Must observe all shop-specific rules beyond the scope of this policy.
- e. Must report all injuries to a Shop Supervisor promptly, regardless of seriousness.
- f. Must promptly report unsafe conditions, actions or near-miss incidents to Shop Supervisor.

2. Other Users

- a. All users intend to use a machine shop must obtain a valid pass.
- b. Must complete general shop safety training and machine specific training provided by the Shop Supervisor before using any machine.
- c. Must observe all shop safety rules when working in the machine shop.
- d. Must use “Buddy System” when working in the shop.
- e. Must report all injuries to the Shop Supervisor promptly, regardless of seriousness.
- f. Must work with a Shop Supervisor for specific needs.

3. Shop Supervisor

- a. Must ensure that all users of shop are familiar with general and shop-specific safety rules.
- b. Must enforce all safety rules and make all users aware of the consequences of rule violations.
- c. Must ensure that all users of shop have attended general shop safety and machine-specific training before starting their work in the shop.
- d. Must provide tool/equipment specific training to each user of the equipment they will be using.
- e. Must investigate all accidents and near-miss incidents and ensure timely correction of unsafe conditions.
- f. Must give full support to all safety procedures, activities and programs.
- g. Must maintain all training records on the Training Record Form for inspection by EH&S.
- h. Must maintain access to MSDS for all chemicals used in the shop.

4. Department

- a. Must ensure that adequate supervision is provided for the shop staff.
- b. Must provide adequate resources for maintenance, repairs and safe guarding equipment.
- c. Must inform all shop users to follow University policy and safety rules.

5. Environmental Health and Safety (EH&S)

- a. Must periodically review and update this policy and training.
- b. Must conduct periodic audits of various shops.
- c. Must maintain general shop safety training records.
- d. Must provide respirator fit testing, when needed.

TRAINING

Anyone using a machine shop at UNT is required to attend two types of training:

1. General Shop Safety Training

Training is provided by shop supervisor. After completing training, the user must complete the test, print a certificate of completion and provide a copy to the Shop Supervisor to arrange for machine-specific training.

Shop Safety Guidelines

2. Machine Specific Training

Machine-specific hands-on training is provided by the Shop Supervisor before using a machine. This training will NOT be offered unless general safety training is completed.

The training should involve instructions and hands-on demonstration in the following:

- a. Description and identification of the hazards associated with a particular machine;
- b. Proper safety precautions when working with a particular machine;
- c. Limitations of the tools/equipment and when and what NOT to use;
- d. Safeguards, protection they provide, and ensuring their presence before using a machine;
- e. What to do (e.g., contact supervisor, tag the machine) if a damaged guard, missing part, unusual noise, etc., is noticed.
- f. How to use emergency buttons and other measures, when needed.
- g. Maintenance and cleaning procedures

RECORD KEEPING

1. **General safety records** shall be maintained in general database.
2. **Machine specific training records** shall be maintained by the Shop Supervisor using form in Appendix II.

REFERENCES

1. OSHA Standard 29 CFR 1910.22 General requirements
2. OSHA Standard 29 CFR 1910.35. Means of Egress
3. OSHA Standard 29 CFR 1910.133. Eye and Face Protection
4. OSHA Standard 29 CFR 1910.134. Respiratory Protection
5. OSHA Standard 29 CFR 1910.135. Hand Protection
6. OSHA Standard 29 CFR 1910.136. Foot Protection
7. OSHA Standard 29 CFR 1910.178. Powered Industrial Trucks
8. OSHA Standard 29 CFR 1910. 212.General Requirements for all Machines
9. OSHA Standard 29 CFR 1910.242. Hand and Power Tools and Equipment, General
10. OSHA Standard 29 CFR 1910.243. Guarding of Portable powered Tools.
11. OSHA Standard 29 CFR 1910.252. General requirements for Welding
12. UCSB and U of Florida Shop Policy Guidelines

APPENDICES

Appendix I. Shop Safety Work Group

Appendix II. Machine Specific Training Record

Form Appendix III. Specific Machine Use Guidelines

1. Drill Press Safety Guidelines
2. Lathe Machine Safety Guidelines
3. Milling Machine Safety Guidelines
4. Band Saw Safety Guidelines
5. Grinding Machine Safety Guidelines

Shop Safety Guidelines

6. Disc and Belt Sander Safety Guidelines
7. Welding Safety Guidelines

Appendix IV. Hand Tools Safety Guidelines

Appendix V. Floor Marking Guidelines

Appendix VI. Mechanical Motions and Actions

Shop Safety Guidelines

APPENDIX I

SHOP SAFETY WORK GROUP

Names and positions:

Rick Pierson - ETC

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APPENDIX II

MACHINE SPECIFIC TRAINING RECORD FORM

The student, or faculty member listed below has satisfactorily been trained on the safe use and operation of the specified shop equipment.

Name (please print): _____

UNT Email Address: _____

Expected Graduation Date: _____

Department / Degree Plan: _____ Title (student / TA / instructor): _____

Applicant Signature: _____ Date: _____

STAFF USE ONLY BELOW THIS LINE

Shop Equipment Approved for Use (initial all that apply):

Date Approved	Shop Equipment	Staff Initial
	Horizontal Band Saw	
	Vertical Band Saw	
	Abrasive Saw	
	Cold Saw	
	Drill Press	
	Bench Grinder	
	Belt Sander	
	Surface Grinder	
	Welders	
	Mill	
	Lathe	

Shop Supervisor Signature: _____ Date: _____

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APPENDIX III

SPECIFIC MACHINE USE GUIDELINES

Following are just general safety guidelines for various machines and tools normally present in machine shops. These are not specific rules. Each Shop Supervisor will set special rules applicable to that shop that must be followed. If there is any question you must consult your Shop Supervisor.

Drill Press Safety Guidelines

1. You must attend general and machine specific safety trainings and wear proper PPE before using machine.
2. Run drill at correct RPM for diameter of drill bit and material. Ask a Shop Supervisor for the correct RPM.
3. Always hold work to the drill table in a vise or clamp.
4. Use a correctly ground drill bit for the material being drilled. The Shop Supervisor can help select the correct bit.
5. Use the proper cutting fluid for the material being drilled. Ask a Shop Supervisor 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 Shop Supervisor 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 thru 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 shop superintendent for advice on drill and coolant selection when drilling these materials.

Lathe Safety Guidelines

1. You must attend general and machine specific safety trainings and wear proper PPE before using a machine.

Shop Safety Guidelines

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 slides 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 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.

Milling Machine Safety Guidelines

1. You must attend general and machine specific safety trainings and wear proper PPE before using a machine.
2. Work must be clamped securely in a vise and vise clamped tightly to the table, or, work must be clamped securely to the table.
3. Do not take climb milling cuts.
4. Make sure cutter is rotating in the proper direction before cutting material.
5. Before running machine rotate the spindle by hand to make sure it is clear for cutting.
6. Make sure the power is off before changing cutters.
7. Always use the proper cutting fluid for the material being cut.
8. Never run the machine faster than the correct cutting speed.
9. Make sure that the machine is fully stopped before taking any measurements.
10. Always use cutters which are sharp and in good condition.
11. Do not place anything on the milling machine table such as wrenches, hammers, or tools.
12. Always stay at the machine while it is running.
13. Do not take too heavy a cut or use too rapid a feed.

Shop Safety Guidelines

14. Remove the collet tightening wrench immediately after using it.
15. If at all feasible rig a guard or shield to prevent chips from hitting other people.
16. Use the milling machine spindle brake to stop the spindle after the power has been turned off.
17. Before cleaning the mill remove cutting tools from the spindle to avoid cutting yourself.

Band Saw Safety Guidelines

1. You must attend general and machine specific safety trainings 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 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.

Grinding Safety Guidelines

1. You must attend general and machine specific safety trainings 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 side of wheel unless wheel is specifically designed for such use.
8. Do not use excessive pressure while grinding. Report to the Shop Supervisor immediately any cracked, broken or otherwise defective wheels.
9. Have the area supervisor 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.

Shop Safety Guidelines

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.

Disc and Belt Sander Safety Guidelines

1. You must attend general and machine specific safety trainings and wear proper PPE before using machine.
2. Do not operate sanders without the guards in place.
3. On the disc sander always use the downward motion side of the disc to sand and never the upward motion side as this can throw your part upwards with tremendous force.
4. Always attempt to place your work against the rest on the disc and belt sanders.
5. On the horizontal belt sander, always sand so that the belt motion is away from you.
6. Do not operate machines with torn or ripped belts or disks.
7. Do not sand any material that will give off a dangerous dust. Such materials as beryllium or copper beryllium alloys must not be sanded or filed. Asbestos must not be sanded. Asbestos is an ingredient of brake shoes and pads.

Welding Safety Guidelines

1. You must attend general and machine specific safety trainings and wear proper PPE before starting work.
2. Shop Supervisor 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 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 work table 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.

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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. Do not use any type of respirator without medical clearance, training and fit testing. You must contact your Shop Supervisor or EH&S in case you need a respirator.
18. Check the ventilation system before starting to weld and periodically thereafter to insure adequate performance. Welding fumes should not be allowed to get into the rest of the shop working areas.
19. Never cut or weld any container that has held explosive or flammable materials. Use prescribed methods for cleaning or flooding.
20. 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.
21. Abide by any other safety measures required for each particular type of welding.
22. Allow for proper ventilation when brazing or soldering. The fluxes are acidic and toxic.
23. 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.

Heavy Sanding of Wood and Foam Safety Guidelines

1. You must attend general and machine specific safety trainings and wear proper PPE before using a machine.
2. Safety glasses must be worn when sanding.
3. Sand in a well-ventilated area away from other machines, only on the patio with the doors to the shop closed.
4. Use a vacuum or a dust collector to collect dust while sanding to prevent the dispersal over a large area.
5. A dust mask may be worn if needed based on the assessment made by the Shop Supervisor. Contact Safety Risk Manager if risk assessment is needed.

Safeguarding Guidelines

Dangerous moving parts in these three basic areas need safeguarding:

1. The point of operation: that point where work is performed on the material, such as cutting, shaping, boring, or forming of stock.
2. Power transmission apparatus: All components of the mechanical system which transmit energy to the part of the machine performing work. These components include flywheels, pulleys, belts, connecting rods, couplings, cams, spindles, chains, cranks, and gears.
3. Other moving parts: All parts of the machine which moves while the machine is working. These can include reciprocating, rotating, and transverse moving parts, as well as feed mechanisms and auxiliary parts of the machine.

Shop Safety Guidelines

APPENDIX IV

Hand Tools Safety Guidelines

Hand tools are non-powered tools. They include axes, wrenches, hammers, chisels, screw drivers, and other hand-operated mechanisms. Hand tool injuries are more common because people take everyday hand tools for granted; they forget to follow simple precautions for safety. The most common hand tool accidents are caused by the following:

1. Failure to use the right tool
2. Failure to use a tool correctly
3. Failure to keep edged tools sharp
4. Failure to replace or repair a defective tool.
5. Failure to store tools safely

How to Use Tool Safely:

You must attend general and machine specific safety trainings and wear proper PPE before using such tools. Follow these guidelines for general hand tool safety:

1. Use the right tool to complete a job safely and efficiently.
2. Wear safety glasses whenever you hammer or cut, especially when working with surfaces that chip or splinter.
3. Do not use a screwdriver as a chisel. The tool can slip and cause a deep puncture wound.
4. Do not use a chisel as a screwdriver. The tip of the chisel may break and cause an injury.
5. Do not use a knife as a screwdriver. The blade can snap and injure an eye.
6. Never carry a screwdriver or chisel or sharps in your pocket. If you fall, the tool could cause a serious injury. Instead, use a tool belt holder.
7. Replace loose, splintered, or cracked handles. Loose hammer, axe, or maul heads can fly off defective handles.
8. Use the proper wrench to tighten or loosen nuts. Pliers can chew the corners off a nut.
9. When using a chisel, always chip or cut away from yourself. Use a soft-headed hammer or mallet to strike a wooden chisel handle. A metal hammer or mallet may cause the handle to split.
10. Do not use a wrench if the jaws are sprung.
11. Use impact tools, such as chisels, wedges, or drift pins, if their heads are mushroom-shaped. The heads may shatter upon impact.
12. Direct saw blades, knives, and other tools away from aisle areas and other employees.
13. Keep knives and scissors sharp. Dull tools are more dangerous than sharp tools.
14. Iron or steel hand tools may cause sparks and be hazardous around flammable substances. Use spark-resistant tools made from brass, plastic, aluminum, or wood when working around flammable hazards.

How to Store Tools:

Improper tool storage is responsible for many shop accidents. Follow these guidelines to ensure proper tool storage:

1. Have a specific place for each tool.
2. Do not place unguarded cutting tools in a drawer. Many hand injuries are caused by rummaging through drawers that contain a jumbled assortment of sharp-edged tools.

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3. Store knives or chisels in their scabbards.
4. Hang saws with the blades away from someone's reach.
5. Provide sturdy hooks to hang tools on.
6. Rack heavy tools, such as axes and sledges, with the heavy end down.

Floor Markings Guidelines

1. Traffic Area – main traffic routes through lab; keep area clear of obstructions; beware of moving vehicles.
2. Physical Hazard Area – this area contains a physical hazard, entry by laboratory staff only (yellow cones are equivalent to yellow lines).

Hazardous Mechanical Motions and Actions

A wide variety of mechanical motions and actions may present hazards to the worker. These can include the movement of rotating members, reciprocating arms, moving belts, meshing gears, cutting teeth, and any parts that impact or shear. These different types of hazardous mechanical motions and actions are basic to nearly all machines, and recognizing them is the first step toward protecting workers from the danger they present. The basic types of hazardous mechanical motions and actions are:

Motions

- rotating (including in
- reciprocating**
- transverse

Actions

- cutting
- punching
- shearing
- bending

Brief examination of each of these basic types:

Motions:

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

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

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

1. Parts can rotate in opposite directions while their axes are parallel to each other. These parts may be in

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contact (producing a nip point) or in close proximity to each other. In the latter case the stock fed between the rolls produces the nip points. This danger is common on machinery with intermeshing gears, rolling mills, and calendars.

2. Another nip point is created between rotating and tangentially moving parts. Some examples would be: the point of contact between a power transmission belt and its pulley, a chain and a sprocket, or a rack and pinion.
3. Nip points can occur between rotating and fixed parts which create a shearing, crushing, or abrading action. Examples are: spoked hand wheels or flywheels, screw conveyors, or the periphery of an abrasive wheel and an incorrectly adjusted work rest.

Reciprocating motions may be hazardous because, during the back-and-forth or up-and-down motion, a worker may be struck by or caught between a moving and a stationary part.

Transverse motion (movement in a straight, continuous line) creates a hazard because a worker may be struck or caught in a pinch or shear point by the moving part.

Actions:

Cutting action involves rotating, reciprocating, or transverse motion. The danger of cutting action exists at the point of operation where finger, head, and arm injuries can occur and where flying chips or scrap material can strike the eyes or face. Such hazards are present at the point of operation in cutting wood, metal, or other materials. Typical examples of mechanisms involving cutting hazards include band saws, circular saws, boring or drilling machines, turning machines (lathes), or milling machines.

Punching action results when power is applied to a slide (ram) for the purpose of blanking, drawing, or stamping metal or other materials. The danger of this type of action occurs at the point of operation where stock is inserted, held, and withdrawn by hand. Typical machinery used for punching operations are power presses and iron workers.

Shearing action involves applying power to a slide or knife in order to trim or shear metal or other materials. A hazard occurs at the point of operation where stock is actually inserted, held, and withdrawn. Typical examples of machinery used for shearing operations are mechanically, hydraulically, or pneumatically powered shears. Bending action results when power is applied to a slide in order to draw or stamp metal or other materials, and a hazard occurs at the point of operation where stock is inserted, held, and withdrawn. Equipment that uses bending action includes power presses, press brakes, and tubing benders.

