

College of Engineering --- Colorado State University  
Machine Shop Operational Policy  
Engineering Research Center  
November 2011





# Table of Contents

---

<b>1.0 Introduction and Context</b> .....	- 1 -
<b>1.1 Purpose</b> .....	- 1 -
<b>1.2 Introduction</b> .....	- 1 -
<b>1.3 Contact Information</b> .....	- 1 -
<b>2.0 Safety: Rules, Procedures and Guidelines</b> .....	- 1 -
<b>2.1 General Shop Safety Rules and Conduct:</b> .....	- 1 -
<b>2.2 Personal Protective Equipment (Eyes, Ears, Respiration, Body, Hands)</b> .....	- 3 -
<b>2.2.1. Protective Clothing</b> .....	- 3 -
<b>2.2.2 Eye Protection</b> .....	- 3 -
<b>2.2.3 Protective Gloves</b> .....	- 4 -
<b>2.2.4 Respirators</b> .....	- 4 -
<b>2.2.5 Other Personal Protective Equipment</b> .....	- 4 -
<b>2.3 Compressed Air</b> .....	- 4 -
<b>2.4 Proper Machine Use Guidelines</b> .....	- 4 -
<b>2.4.1 Drill Press Safety Guidelines</b> .....	- 4 -
<b>2.4.2 Lathe Safety Guidelines</b> .....	- 5 -
<b>2.4.3 Milling Machine Safety Guidelines</b> .....	- 6 -
<b>2.4.4 Band Saw Safety Guidelines</b> .....	- 6 -
<b>2.4.5 Grinding Safety Guidelines</b> .....	- 7 -
<b>2.4.6 Table Saw Safety Guidelines</b> .....	- 7 -
<b>2.4.7 Power Hand (Skill) Saw Safety Guidelines</b> .....	- 8 -
<b>2.4.8 Disc and Belt Sander Safety Guidelines</b> .....	- 9 -
<b>2.4.9 Welding Safety Guidelines</b> .....	- 9 -
<b>2.4.10 Heavy Sanding of Wood and Foam Safety Guidelines</b> .....	- 10 -
<b>2.5 Machine Guarding</b> .....	- 10 -
<b>2.6 Ventilation / Illumination</b> .....	- 10 -
<b>2.7 Emergency Eyewash Station</b> .....	- 11 -
<b>2.8 Fire Extinguishers and Exits</b> .....	- 11 -
<b>2.9 Combustibles</b> .....	- 11 -
<b>2.10 Electrical</b> .....	- 11 -
<b>2.11 Safety Orientation</b> .....	- 12 -
<b>2.12 Safety Violations</b> .....	- 12 -

2.13 Toxic and Hazardous Substances .....	- 12 -
2.14 Accident and Emergency Procedures .....	- 12 -
3.0 Machine Shop Use.....	- 12 -
3.1 Hours of Operation.....	- 12 -
3.2 CNC Hours of Operation.....	- 13 -
3.3 Labor and Materials Pricing .....	- 13 -
3.4 Visitor Use .....	- 13 -
3.5 Use of Materials .....	- 13 -
3.6 Tool Checkout.....	- 13 -
3.7 Project Storage .....	- 13 -
3.8 Food and Drink .....	- 13 -
4.0 Security .....	- 14 -
4.1 Security Cameras.....	- 14 -
4.2 Key and Card Reader Access .....	- 14 -
5.0 Maintenance / Upkeep .....	- 14 -
5.1 Tool Upkeep .....	- 14 -
5.2 Recycling and Waste .....	- 14 -
5.3 Cleanliness.....	- 15 -
6.0 Certifications and Trainings .....	- 15 -
6.1 General Shop Training.....	- 15 -
6.2 Machine Specific Trainings.....	- 15 -
7.0 Staff Management.....	- 15 -
7.1 Equipment and Supply Purchase .....	- 15 -
7.2 Duties and Functions.....	- 15 -
8.0 Forms .....	- 17 -
8.1 ERC MACHINE SHOP GENERAL TRAINING COMPLETION FORM.....	- 17 -
8.2 ERC MACHINE SHOP ACCIDENT REPORT .....	- 18 -
8.3 ERC MACHINE SHOP USER ACKNOWLEDGEMENT FORM .....	- 19 -
8.4 ERC MACHINE SHOP VISITOR USE FORM .....	- 20 -
8.5 ERC MACHINE SHOP SAFETY VIOLATION REPORT .....	- 21 -
8.6 ERC MACHINE SHOP TOOL MAINTENANCE FORM.....	- 22 -

# 1.0 Introduction and Context

---

## 1.1 Purpose

This policy establishes safe work practices for students, staff and visitors working in Engineering Research Center machine shop. It defines safety guidelines, machine maintenance, certification and training requirements and response procedures in case of emergency to minimize injuries and illness when working in a machine shop.

## 1.2 Introduction

The Engineering Research Center machine shop is used by faculty, staff, students, alumni and visitors of Colorado State University. Shop equipment and tools are routinely used to complete various projects that, if not handled properly, may result in 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 this machine shop, to establish fundamental shop safety rules and to outline the use of safe work practices and use of proper personal protective equipment. Use of this facility is a privilege, not a right. Access will be revoked for safety and policy violations. Each user of the machine shop is required to complete general shop safety training. However, this training is not a substitute for a machine-specific safety training that should be provided by your shop supervisor. User 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, and visitors.

## 1.3 Contact Information

---

Name	Phone	Email
Emergency	911	
Chris Thornton – Director of ERC	970 491-8394	Christopher.Thornton@colostate.edu
Jesse Parker – Facilities Coordinator	970 491-3885	Jesse.Parker@colostate.edu
Junior Garza – Shop Supervisor	970 491-8664	Garza@colostate.edu
Bart Rust – Instrument Fabricator	970 491-8664	BRust@colostate.edu
CSU Police Department	970 491-6425	
Environmental Health Services (EHS)	970 491-6745	EHS@colostate.edu

---

# 2.0 Safety: Rules, Procedures and Guidelines

---

## 2.1 General Shop Safety Rules and Conduct:

These guidelines DO NOT serve as a replacement for formal training in lab techniques or shop safety. Only trained personnel may 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 complete 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.*

**3. Never use a 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 grounds 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 a hurry. If it cannot be done safely don't start it.*

**5. Never wear open toe or open heel shoes - use closed-toe shoes in the shop.**

*Sandals, flip-flops or other open-toe and open-heel shoes are strictly 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. 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 personal 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.*

**10. 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.*

**11. 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. Failure to adhere will result in loss of privileges.*

**12. Never remove safety guards – they are present for a 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.*

**13. Never use gloves while using rotating equipment – remove them before starting work.**

*Gloves can become entangled in rotating machine parts resulting in serious injuries.*

**14. 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 the shop supervisor to arrange repair before next use.*

**15. 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.*

## **2.2 Personal Protective Equipment (Eyes, Ears, Respiration, Body, Hands)**

Personal Protective Equipment (PPE) is designed to prevent personal injury. Examples of personal protective equipment (PPE) include safety glasses or goggles, face shields, safety shields, gloves, respirators, and hearing protection. It is the responsibility of the user to ensure that the necessary safety equipment is used.

### **2.2.1. Protective Clothing**

When working with a potentially hazardous material, protective clothing is required.

-Protective clothing is chosen, with the aid of the machine shop staff, on the basis of the proposed hazard and medical condition of the user.

-Loose clothing, such as neckties, sweaters, flowing sleeves, lanyards, necklaces and other loose/dangling jewelry shall not be worn in the machine shop.

-Rings, bracelets, wristwatches and related should be removed prior to machine use.

-Do not use heavy work gloves in close proximity to moving machinery. "Surgical" type gloves (those that have low tear strength) are permissible.

-Shorts or pants with cuffs should be avoided during shop use.

-Long hair must be tied back.

-Closed-toed shoes will be worn in the machine shop at all times.

-Reusable protective clothing, such as work gloves, face shields, and respirators, must be visually inspected prior to use to ensure that they are in good condition.

### **2.2.2 Eye Protection**

Safety glasses or goggles must be worn in the machine shop.

Ordinary prescription glasses are not designed to provide adequate protection against occupational hazards. Prescription safety glasses are recommended for employees who must routinely wear safety glasses in lieu of fitting safety glasses over their personal glasses.

Additional eye or face protection may be required when there is a potential for hazardous materials, including chemicals, ultraviolet light radiation, and wood, metal, and plastic shavings or particulates, to come in contact with the eyes or face. Examples of eye/face protection include safety glasses, goggles, and face shields. All protective eye and face devices must meet the American National Standards Institute Z87.1-1989 standard.

### **2.2.3 Protective Gloves**

When working with electrical, temperature, or mechanical/physical hazards, appropriate work gloves (e.g., cryogenic gloves, electrical safety gloves) are required. When working with hazardous chemicals, such as solvents and corrosive materials, chemical-resistant gloves are required.

### **2.2.4 Respirators**

The use, selection, training for any required respirators, if applicable is the responsibility of the ERC machine shop staff. Dust masks may be worn for personal comfort, but are not designed for or approved by the National Institute for Occupational Safety and Health (NIOSH) for protection against hazardous chemicals or biological agents.

### **2.2.5 Other Personal Protective Equipment**

Other PPE, such as hearing protection, shall be used as needed. Prior to wearing hearing protection, or if new equipment is installed that may present a noise issue, contact the Shop supervisor.

Note: PPE should not be worn in common areas  
(Bathrooms, outside, conference rooms, break rooms, elevators, etc.)

## **2.3 Compressed Air**

Under Title 29 Code of Federal Regulations (CFR) Section 1910.242(b), the following rules must be followed when using compressed air for cleaning.

- Compressed air must not be used to clean your clothing or yourself.
- Compressed air must not be directed at people.
- Compressed air used for cleaning work areas, such as work benches, table saws, and drill presses, shall not exceed 30 pounds per square inch at the outlet.
- Chip guarding must be used and appropriate eye protection must be worn when using compressed air.

## **2.4 Proper Machine Use Guidelines**

The following are general safety guidelines for the various machines and tools present in machine shop. You must attend general and machine specific safety trainings and wear proper personal protective equipment (PPE) before using machine.

### **2.4.1 Drill Press Safety Guidelines**

1. You must attend general and machine specific safety trainings and wear proper personal protective equipment (PPE) before using machine.
2. Run drill at correct RPM for diameter of drill bit and material. Consult the 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. If 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 supervisor for advice on drill and coolant selection when drilling these materials.

#### 2.4.2 Lathe Safety Guidelines

1. You must attend general and machine specific safety trainings and wear proper personal protective equipment (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 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 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.

### **2.4.3 Milling Machine Safety Guidelines**

1. You must attend general and machine specific safety trainings and wear proper personal protective equipment (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 unless working on a CNC milling machine, or as a finish pass of less than .005”.
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.
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.

### **2.4.4 Band Saw Safety Guidelines**

1. You must attend general and machine specific safety trainings and wear proper personal protective equipment (PPE) before using a machine.
2. The upper guide and guard should be set as close to the work as possible, at least within 1/8”.
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.

#### 2.4.5 Grinding Safety Guidelines

1. You must attend general and machine specific safety trainings and wear proper personal protective equipment (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"** 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 shop 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.
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.

#### 2.4.6 Table Saw Safety Guidelines

1. You must attend general and machine specific safety trainings and wear proper personal protective equipment (PPE) such as goggles before using machine.
2. You may not operate a table saw without permission from the shop supervisor.
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 shop supervisor 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 in the kick-back zone.
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 collect 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.
17. **Do not crosscut using the rip fence – use the mitre (crosscut) fence only. Do not rip using the mitre (crosscut) fence – use the rip fence only.**

#### **2.4.7 Power Hand (Skill) Saw Safety Guidelines**

1. You must attend general and machine specific safety trainings and wear proper personal protective equipment (PPE) before using machine.
2. Unplug the tool before making any adjustments.
3. Before using any power tool, inspect it to make sure the cord is not damaged in any way, that the ground pin is intact, and that the blade is sharp and undamaged.
4. Do not use the saw in a wet area.
5. Do not run the extension cord across walkways where people might trip over it or where the cord may be run over and damaged.
6. Keep your head out of the path of particles thrown out by the blade. Wear proper eye protection.
7. Wait until the saw stops before lifting it from a cut.
8. Disconnect the power cord before cleaning, changing blades, or making any adjustments to the saw.
9. When it is necessary to raise the guard for certain types of cuts, use the guard lever.
10. **Never wedge, wire, or otherwise jam the guard to prevent it from working. This is a particularly dangerous practice and will cause your permission to work in the machine shop to be revoked immediately.**
11. Before setting the saw down, make sure the guard is closed, as the blade may still be turning.
12. Do not carry the saw with your fingers on the switch trigger.
13. Do not pull the saw backwards in a cut if you can avoid it.
14. Use the proper blade for the type of cut to be made.
15. Do not use the cord to move or drag the saw.
16. Do not use the power hand saw for cuts if you cannot keep a firm and secure grip on the saw and the material being cut. A hand saw is still the best tool for some kinds of work and often faster.
17. Before cutting small work pieces shop personnel should be consulted.
18. Adjust the depth of cut 1/8" greater than the material thickness.

#### 2.4.8 Disc and Belt Sander Safety Guidelines

1. You must attend general and machine specific safety trainings and wear proper personal protective equipment (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.

#### 2.4.9 Welding Safety Guidelines

1. You must attend general and machine specific safety trainings and wear proper personal protective equipment (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 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 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.
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 Environmental Health Services 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.
24. **Never regulate acetylene pressure higher than 15 PSI!**

#### **2.4.10 Heavy Sanding of Wood and Foam Safety Guidelines**

1. You must attend general and machine specific safety trainings and wear proper personal protective equipment (PPE) before using a machine.
2. Safety glasses must be worn when sanding.
3. Sand in a well-ventilated area away from other machines.
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 Environmental Health Services if risk assessment is needed.

#### **2.5 Machine Guarding**

Machine guarding is required by OSHA under 29 CFR 1910.211. A guard is a barrier that prevents the entry of the operator's hands or fingers into any part of a machine or piece of equipment where they may be cut or caught between moving parts, between moving and stationary parts, or between the material and moving parts of the machine.

Guarding is required of machine tools. Hand-held, portable power tools or manual tools are not required to be guarded.

Machine guarding provided by the manufacturer should never be removed from the machine.

#### **2.6 Ventilation / Illumination**

There are many health risks associated from working in a machine shop. Overlooked risks include those that don't pose an immediate threat but rather a long term threat. When using chemicals, gases, and creating any type of dust, always work in a well ventilated area. Consider others in the shop as well and the air quality that you may be decreasing. Work near doors or outside, use dust collection and fans depending on the activity. Use dust masks and respirators when necessary.

Similarly, working in dark, poorly lit environments will have a long term impact on vision. Choose a workspace that is well lit. Setup extra lights when necessary. Contact the shop supervisor to request additional permanent light fixtures where needed.

## 2.7 Emergency Eyewash Station

There is an emergency eyewash station located in the machine shop. In case you need to use this station, call out for help to someone in the shop to guide you to the station. Keep your eyes open after commencing eye washing and wash eyes for a minimum of 15 minutes. It is important to get medical attention as soon as possible when eyes are contaminated.

## 2.8 Fire Extinguishers and Exits

Several fire extinguishers are located around the shop area. Familiarize yourself with these locations and their use. It is of great importance to know the type of fire extinguisher you are using. Using the wrong class of extinguisher for the wrong type of fire can be very dangerous. You should only attempt to extinguish small fires, never an out-of-control fire such as one that has reached the ceiling. In the case of an out-of-control fire, pull a fire alarm and quickly exit the building. Never use a fire extinguisher when there is no escape route, there is a dangerous amount of smoke, or there is an explosion hazard. Certain types of metals are combustible and create a particular fire danger including aluminum, lithium, magnesium, and titanium. Never use water to extinguish a fire that may include these metals.

As there are many exits in the machine shop. Use the closest exit that leads away from the fire as a fire escape route. Review posted fire escape routes to be prepared for a fire evacuation. Upon exiting the building, maintain a distance of at least 50 feet between yourself and the building and keep clear of emergency equipment and personnel. Do not re-enter the building after a fire alarm has been triggered until cleared by the appropriate authority.

## 2.9 Combustibles

Combustibles shall be stored only in approved locations. Keep open flames away from all combustibles. Return combustibles to storage immediately after use.

## 2.10 Electrical

Electricity poses a serious workplace hazard. Electrical current passing through the human body can cause electrical shock and result in burns, muscle damage and other physical injury, and nervous/respiratory system damage or failure.

In order to minimize risk from electricity, the following procedures should be followed:

- Avoid using electrical devices in wet conditions.
- Use Ground Fault Circuit Interrupters when possible and in all wet locations.
- Use the correct wiring and connectors.
- Avoid long-term (e.g., more than one month) use of extension cords.
- Use and maintain tools properly. **Do NOT use damaged or improperly modified electrical tools or devices.**
- Avoid wearing items such as watch bands, jewelry, etc. that could come into contact with exposed, energized parts.
- Always check cords for wear and damage, and replace any damaged cords.
- Never use a 3-wire cord with a 2-wire plug.
- Never remove the third prong to make a 3-prong plug fit a 2-prong outlet.

- Do not overload outlets.
- Do not use attached electrical cords to move equipment.
- Always verify that the power is off before making repairs to electrical equipment. **Lockout/tagout procedures must be used to ensure power is off.**

Neither ERC machine shop staff nor its users should attempt to repair fuse boxes or high-voltage equipment. If there is an electrical problem in the machine shop, contact CSU Facilities Dispatch and Work Order Requests at 970 491-0077. If electrical equipment is damaged or appears unsafe, do not use it and report the situation to the shop supervisor.

### **2.11 Safety Orientation**

Every user must complete a safety training orientation. This orientation will cover the general shop safety rules and conduct, ventilation and illumination, emergency eyewash stations, proper fire extinguisher use, safety protocol violations, and compressed air. Upon completion of the orientation each user must pass a short online test to gain shop use privileges. First time offenses will result in a written warning and a reduction of privileges. Second time offenses will result in termination of privileges.

### **2.12 Safety Violations**

Safety is very serious at the ERC machine shop and accordingly safety violations will be taken very seriously. Staff may choose to revoke shop access upon first violation depending on the severity. The standard first violation shall result in

### **2.13 Toxic and Hazardous Substances**

Properly dispose of toxic and hazardous substances. Never dispose of toxic or hazardous substances in sinks or floor drains.

### **2.14 Accident and Emergency Procedures**

If you or another shop user is injured, inform a staff member immediately. For serious injuries, call 911 to request an ambulance. Those assisting the injured person should turn off tools that were used by the injured person and do a quick cleanup after immediately attending to their needs. An accident report must be filled out within three days following the accident.

## **3.0 Machine Shop Use**

---

### **3.1 Hours of Operation**

The ERC machine shop is open from 7:30am to 4pm from Monday to Friday except on university holidays. Access to the shop may be limited during scheduled classes and trainings, staff vacation, or shop maintenance. Contact shop supervisor for a detailed schedule and additional information. Access to the shop is a privilege and not a right and may be revoked for failure to adhere to shop policies.

### **3.2 CNC Hours of Operation**

Hours of use for the CNC machine are 24 hours per day and 7 days a week. However, the “buddy system” policy is constantly enforced. You must have another adult present to operate this machine.

### **3.3 Labor and Materials Pricing**

Each user will be assessed a \$20.00 per hour charge for using the shop. This charge includes professional guidance, basic tooling, and will be used to purchase new equipment for the shop. Unique tooling will need to be purchased from the supply room separately. “Shop Use” consists on being on the shop premise even if no tools or machines are in use. Account balances will be charged out once a month based on the account number provided. Users who default on their shop bill will not be allowed in the shop and further action may be pursued. The shop staff is available to assist users at no additional charge. Customers may also request completion of work by the ERC machine shop billed at normal shop rates. Staff will offer a price quote for work including labor and materials if requested. The staff may adjust the actual labor charge by up to 20% of the estimated time depending on actual time spent. Material costs shall be provided at the time of inquiry.

### **3.4 Visitor Use**

Any visiting user of the machine shop who is not certified by the ERC machine shop must obtain written permission from the shop supervisor and adhere to all rules applicable to certified students, staff and faculty. No exceptions are made for visitors.

### **3.5 Use of Materials**

Each user of the ERC machine shop must supply his or her own materials. Some materials may be purchased from the machine shop. Additionally, contracting the machine shop for certain jobs will likely include the cost of materials in a cost estimate.

### **3.6 Tool Checkout**

Certain tools are available to checkout from the ERC machine shop. Use the online checkout to reserve a tool. Follow further guidelines for borrowing on the checkout form.

### **3.7 Project Storage**

Short term storage and specific group storage is available. Reserved areas may be used until a project is completed. Coordinate with the shop supervisor about the size of storage required and duration of your project for availability. The ERC machine shop is not responsible for theft or damage done to any project.

### **3.8 Food and Drink**

Food and drink are permitted in the ERC machine shop. Please be respectful and clean up after yourself.

## 4.0 Security

---

### 4.1 Security Cameras

The ERC machine shop shall keep a seven day video record of the shop areas. This footage may be viewed or reviewed at any time to ensure safety of shop occupants and enforcement of policy. By signing the User Acknowledgment Form, you agree to these terms.

### 4.2 Key and Card Reader Access

Keys to the ERC machine shop will only be provided to staff. Authorized students will be added to the card reader system. Under no circumstance may a card user lend out their card, even to another authorized user. Users must report stolen cards to the shop supervisor or the facilities coordinator for the College of Engineering. Access to this facility is a privilege and as such may be revoked if policies are breached.

## 5.0 Maintenance / Upkeep

---

### 5.1 Tool Upkeep

The ERC machine shop staff are responsible for the maintenance and upkeep of all tools in the facility. However, as part of proper machine use, some basic maintenance may be required before and/or after use of a particular tool. Please refer to section 2 of this document for proper use of each tool and maintenance that is to be performed.

Staff will not allow use of any machine that is considered broken. Staff is responsible to develop and perform routine maintenance on all machines. Shop users must immediately report maintenance needs using the Tool Maintenance Form found in section 9.6.

### 5.2 Recycling and Waste

The following by-products of the ERC machine shop are recycled. Please put recyclables in the appropriate receptacles. If unsure of your material, please ask. **Steel chips are not recycled!**  
**Steel chips are not recycled! Steel chips are not recycled! Steel chips are not recycled!**  
**Failure to file recyclables properly will result in loss of access and/or certification.**

ALUMINUM "CLIP" = solid pieces that are not chips from machining processes.

ALUMINUM CHIPS = shavings and cuttings resulting from machining processes.

BRASS, BRONZE, & COPPER "CLIP" = solid pieces that are not chips from machining.

BRASS, BRONZE, & COPPER CHIPS = shavings and cuttings resulting from machining.

STAINLESS STEEL "CLIP" = solid pieces that are not chips. Contains no mild or alloy steel.

STEEL "CLIP" = solid pieces that are not chips from machining processes.

WOOD = unfinished hardwood or softwood. NO manufactured forest products such as MDF, particleboard, OSB, plywood, etc.

### **5.3 Cleanliness**

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. Clean and 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 it properly
7. Do not over use compressed air. Do not blow air into the bearing surfaces, and do not scatter chips. Shop vacuum works better than the air gun.
8. Machines that are in use on consecutive days by an individual user may postpone cleanup until project completion, but must be cleaned as needed to prevent excessive buildup of debris or malfunctioning.

## **6.0 Certifications and Trainings**

---

### **6.1 General Shop Training**

Use of the ERC machine shop is prohibited without completion of the General Shop Training. This training will cover the basic guidelines and policies of this document including safety, shop use, storage, and cleanliness. ERC machine shop staff shall offer a group training once a week.

### **6.2 Machine Specific Trainings**

General Shop Training is required to be in the lab while machine specific training is required to use each machine. Users are not permitted to use a tool on which they have not been trained. Using a tool that you are not certified to use will result in immediate revocation of shop certification and a minimum three month ban from the shop.

## **7.0 Staff Management**

---

### **7.1 Equipment and Supply Purchase**

The shop supervisor shall maintain all shop equipment and supplies and may delegate buying responsibility but will ultimately be responsible for upkeep and supply stocking.

### **7.2 Duties and Functions**

The ERC machine shop staff exist to assist undergraduate students, graduate students, as well as each other, in:

- Learning how to manufacture parts, components, assemblies, and products.
- Answering questions about design and fabrication processes.
- Learning how to safely use manufacturing problems equipment.
- Providing resources for solving related to engineering projects.
- Helping to design projects.
- Enforcing the rules.
- Maintaining the shop as a safe, functioning, friendly place to work and learn.



## 8.2 ERC MACHINE SHOP ACCIDENT REPORT

NAME: \_\_\_\_\_ Signature: \_\_\_\_\_

DATE: \_\_\_\_\_

LOCATION: \_\_\_\_\_ ERC MACHINE SHOP \_\_\_\_\_

1. Describe the injury.
  
2. Time and date of accident.
  
3. How did the accident occur?
  
4. Which machine or piece of equipment was involved? Serial Number?
  
5. Were proper safety precautions being used at the time of the accident? Explain.
  
6. Were proper safety clothing and equipment being used at the time of the accident? Explain.
  
7. Was the accident a direct result of a safety violation? Explain.
  
8. Was the user previously informed of the safety rule that should have prevented this accident? Explain.
  
9. What medical treatment was provided?

	Witness 1	Witness 2	Witness 3
Name			
Email			
Phone			

ERC Machine Shop Staff:

NAME: \_\_\_\_\_ Signature: \_\_\_\_\_

DATE: \_\_\_\_\_ Date of Report in Central Office: \_\_\_\_\_

### **8.3 ERC MACHINE SHOP USER ACKNOWLEDGEMENT FORM**

READ THIS DOCUMENT COMPLETELY BEFORE SIGNING. ITS EFFECT IS TO RELEASE COLORADO STATE UNIVERSITY, ITS GOVERNING BOARD, AND THE STATE OF COLORADO FROM ANY LIABILITY RESULTING FROM YOUR PARTICIPATION IN THE ACTIVITIES DESCRIBED BELOW, AND TO WAIVE ALL CLAIMS FOR DAMAGES OR LOSSES AGAINST THE UNIVERSITY RELATED TO SUCH ACTIVITIES EVEN IF THEY RESULT FROM NEGLIGENCE.

#### RELEASE FROM RESPONSIBILITY, ASSUMPTION OF RISK, AND WAIVER

**PARTICIPANT'S FULL NAME:** \_\_\_\_\_

**DATE OF BIRTH (MO/DY/YR):** \_\_\_\_\_

**ADDRESS:** \_\_\_\_\_

**LOCATION OF ACTIVITY(IES):** Colorado State University, ERC Machine Shop and Yard

**DATE(S) OF ACTIVITY(IES):** Beginning this \_\_\_\_ day of \_\_\_\_\_, 20\_\_ and without definite end

**DESCRIPTION OF ACTIVITIES:** To include any and all activities at or related to the ERC Machine Shop

**INSURANCE INFORMATION, IF STUDENT:** I am aware that as a student, I can purchase accident insurance, either through Colorado State University (*if available*) or through another insurance carrier or agent, and (*check one*)  have  have not exercised my right to do so.

**NAME OF INSURANCE CARRIER and POLICY NUMBER:** \_\_\_\_\_

I, the undersigned participant, exercising my own free choice to participate voluntarily in the activities described above, and promising to take due care during such participation, hereby acknowledge that I have been informed of the nature of the activities and that I am aware of the hazards and risks which may be associated with my participation in the above-named activities, including the risks of bodily injury, death or damage to property which may occur from known or unknown causes. I understand, accept, and assume all such hazards and risks, and waive all claims against the State of Colorado, The Board of Governors of the Colorado State University System, and Colorado State University, and other persons as set forth above. I understand that I am solely responsible for any costs arising out of any bodily injury or property damage that I may sustain through my participation in normal or unusual acts associated with the above-named activities, regardless of whose fault may be the cause of my injuries or damages, EVEN IF CAUSED BY CARELESSNESS OR NEGLIGENCE, so long as the conduct which caused the injuries or damages was not grossly negligent, or willful and wanton.

Further, I hereby indemnify and hold harmless The Board of Governors of the Colorado State University System and Colorado State University, and their members, officers, agents, employees, and any other persons or entities acting on their behalf, and the successors and assigns for any and all of the aforementioned persons and entities, against any and all claims, demands, and causes of action whatsoever, whether presently known or unknown, of any person who suffers any injury, disability, death or other harm, to person or property or both as a result of my participation in and/or presence at the above listed activities.

I have had sufficient time to review and seek explanation of the provisions contained above, have carefully read them, understand them fully, and agree to be bound by them. After careful deliberation, I voluntarily give my consent and agree to this Release from Responsibility, Assumption of Risk, and Waiver.

**READ, UNDERSTOOD AND AGREED TO THE ABOVE TERMS THIS \_\_\_\_ DAY OF \_\_\_\_\_, 20\_\_.**

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Witness over 18 years of age (Participant must sign in the presence of the Witness)

**If participant is under the age of 18, his or her parent or legal guardian must also sign:**

I, (printed name) \_\_\_\_\_, am the parent or legal guardian of the participant above. I have read and I understand the provision of this document, and acting on behalf of the participant, I consent to the participant taking part in the activities described above.

\_\_\_\_\_  
Signature of Parent or Legal Guardian (date)

\_\_\_\_\_  
Witness over 18 years of age (Parent or guardian must sign in the presence of the Witness)



## 8.5 ERC MACHINE SHOP SAFETY VIOLATION REPORT

### Violation and Disciplinary Action

Name: \_\_\_\_\_ Engineering Username: \_\_\_\_\_

Date of Violation: \_\_\_\_\_ Time of Violation: \_\_\_\_\_

Location or machine where violation occurred:

<b>This is a record to advise you that on the above date you were observed violating the following ERC machine shop policy(ies):</b>

**You are further advised that repeated violations of safety rules and standards will not be tolerated. Violations may result in injury to yourself or other shop users, thus you are being warned that if your actions are not corrected and the safety program for the shop is not conscientiously observed, you will subject yourself to further disciplinary actions up to and including expulsion from all CSU machine shops.**

\_\_\_\_\_  
Signature of User                      Date

\_\_\_\_\_  
Signature of Supervisor                      Date

**Disciplinary Action Taken:**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## **8.6 ERC MACHINE SHOP TOOL MAINTENANCE FORM**

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Which machines or tools require maintenance?**

**What maintenance is required?**

**Please return completed Tool Maintenance Forms to the shop supervisor.**