



**COLORADO STATE
UNIVERSITY**

**MECHANICAL SHOP SAFETY
MANUAL**

Environmental Health Services

June 2015

INTRODUCTION AND CONTEXT

Purpose

This Manual describes safe work practices for all University mechanical shops (referred to herein as “workshops” or “shops”). It applies to all persons using or visiting a workshop, including faculty, students, staff and visitors, and includes guidelines for basic safety practices, machine maintenance, certification and training requirements, and response procedures in case of an emergency to minimize injuries and illness when working in these shops.

Definition of a Workshop

A workshop is a room or group of rooms in which mechanical work is performed using tools to create or repair objects. This includes metal shops, wood shops, automotive shops, glass shops and electrical shops.

Introduction

Workshops are used by faculty, staff, students, 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 these workshops, to establish fundamental shop safety rules, to outline the use of safe work practices, and use of proper personal protective equipment. Use of these facilities is a privilege, not a right. Access will be revoked for safety and policy violations. Each user of the workshop 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, faculty, staff, and visitors.

1.4 Contact Information

Name	Phone	Email
Emergency	911	
Jeff Breitschopf – Shop Supervisor	970 491-4130	jeff.breitschopf@colostate.edu
CSU Police Department	970 491-6425	
Environmental Health Services (EHS)	970 491-6745	EHS@colostate.edu

SAFETY: RULES, PROCEDURES AND GUIDELINES

General Shop Safety Rules and Conduct

These guidelines DO NOT serve as a replacement for proper training in techniques or shop safety. Only trained personnel may use shop equipment after approval by their supervisor. Failure to follow proper precautions can result in serious injury or death.

Safety Orientation

Every user must complete the General Safety Training. This training will cover the general shop safety rules and conduct, ventilation and illumination, emergency eyewash stations, proper fire extinguisher use, safety protocol violations, compressed air, etc.

Personal Protective Equipment (Eyes, Ears, Respiration, Body, Hands)

Safety in the workshop begins with proper training and use of equipment. After training, the process for ensuring safety starts with engineering controls. Safety features built into the shop are the first step that should be taken to protect individuals. This includes ventilation, enclosure and/or isolation and process control (e.g. wet cutting instead of dry cutting, steam cleaning instead of solvent cleaning, electric motors instead of fueled motors to decrease exhausts).

The second step is to apply administrative controls. These may include performing high risk operations at times when few occupants are present or rotating individuals to reduce worker exposure to hazards.

The third step is to require and use Personal Protective Equipment (PPE) if engineering and administrative controls cannot adequately reduce or eliminate the hazard. Personal Protective Equipment (PPE) is designed to prevent injury and protect health. 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 and his or her supervisor to ensure that the necessary safety equipment is used, in good condition, and is appropriate for the work being performed, and that training is provided on how to properly wear, inspect and remove the PPE.

PROTECTIVE CLOTHING

When working in a hazardous environment, protective clothing is required.

- Protective clothing is chosen, with the aid of the shop staff, on the basis of the proposed hazard.
- Loose clothing, such as neckties, sweaters, flowing sleeves, lanyards, necklaces and other loose/dangling jewelry shall not be worn in the shop.
- Rings, bracelets, wristwatches and related items should be removed prior to machine use.
- Do not use heavy work gloves in close proximity to moving machinery. Such gloves can become caught in a machine, resulting in injury. "Surgical" type gloves (those that have low tear strength) are permissible.

- Shorts and 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 every use to ensure that they are in good condition.

EYE PROTECTION

Safety glasses or goggles must always be worn in the 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. However, safety goggles designed to fit over eyeglasses must always be available for use.

Additional eye or face protection may be required when there is a potential for chemical splashes or fumes, ultraviolet light radiation, or wood, metal, or 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.

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, appropriate chemical-resistant gloves are required.

RESPIRATORS

The use, selection, medical evaluation, training, and fit testing for any required respirators, if applicable, is the responsibility of Environmental Health Services (EHS). 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.

OTHER PERSONAL PROTECTIVE EQUIPMENT

Noise levels must be evaluated by EHS to determine appropriate PPE. Prior to wearing hearing protection, or if new equipment is installed that may present a noise issue, contact the Shop supervisor. Appropriate PPE for welding must be available for the type of welding being performed. Note: PPE should not be worn in common areas such as bathrooms, outside, conference rooms, break rooms, elevators, etc.

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.

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.

Ventilation

There are many health risks associated from working in a shop. Overlooked risks include those that don't pose an immediate threat but rather a long term threat. When using chemicals, gases, or 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 affecting. Temporary ventilation can be achieved by working near an open door or taking the work outside, if it is safe to do so, or using dust collection and fans depending on the activity. Permanent HVAC solutions are required where this type of work is done regularly. Maintain a clean and orderly environment. Use dust masks and respirators, if approved by EHS, when necessary.

Illumination

Working in poorly lit environments can have a long term impact on vision and increase the risk of accidents. Choose a workspace that is well lit. Set up extra lights when necessary. Contact the shop supervisor to request additional permanent light fixtures where needed.

Emergency Showers and Eyewash Stations

The first 10 to 15 seconds after exposure to a hazardous substance, especially a corrosive substance, are critical. Delaying treatment, even for a few seconds, may cause serious injury.

Emergency showers and eyewash stations provide on-the-spot decontamination. They allow workers to flush away hazardous substances that can cause injury.

Accidental chemical exposures can still occur even with good engineering controls and safety precautions. As a result, it is essential to look beyond the use of goggles, face shields, and procedures for using personal protective equipment. Emergency showers and eyewash stations are a necessary backup to minimize the effects of accident exposure to chemicals.

An emergency eyewash station is required in all workshops. 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. Note: The total amount of water in self-contained systems must exceed the volume required to deliver water at the recommended flow rates and flushing times.

Fire Extinguishers and Exits

Fire extinguishers are required in the shop area and must be placed in locations that are visible and accessible to nearby work areas. Familiarize yourself with these locations and their use. It is of great importance to know the type of fire extinguisher you are using. If you cannot see a fire extinguisher from your work area, ask your supervisor to provide one closer to where you work.

Using the wrong class of extinguisher for the wrong type of fire can be very dangerous. For example, you should never use a water base fire extinguisher on an electrical fire because of the risk of shock or on oil or other flammable liquids because it will spread the fire and make it more intense. 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. CO₂ extinguishers may be ineffective for extinguishing wood, paper, cloth, trash and plastics because the ashes may continue to smolder and re-ignite. 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.

Fire extinguishers are mainly used to clear the exit routes so occupants can escape the building. If you do try to extinguish a small contained fire, make sure to have your exit route to your back so that if the fire gets out of your control, the fire is not between you and your exit. Never use a fire extinguisher to fight a fire if the fire has spread beyond the initial point of origin (outside of a trash can, outside of the containment of a machine, etc.), when there is a dangerous amount of smoke or there is an explosion hazard. This does not apply if you are trapped in an area without any route of escape.

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. Report to the designated rally point (building proctor will know this location). Do not re-enter the building after a fire alarm has been triggered until cleared by the appropriate authority.

Combustibles

Combustibles shall be stored only in approved locations. Keep open flames away from all combustibles. Return combustibles to storage immediately after use. Keep all items at least 18" below the ceiling for fire safety.

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, nervous/respiratory system damage or failure, and death. Ensure that all building electrical systems are installed by a certified electrician and that any defects are identified and corrected immediately. This includes required GFI protection and circuit load calculations. All extension cords must be UL approved and not have frays, exposed wires or damaged sockets. Do not run extension cords across walkways unless they are adequately covered or make penetrations in walls or ceilings to pass cords through. Avoid water in all cases. This also applies to cords from all tools in use in the shop.

Safety Violations

Safety is paramount and accordingly safety violations will be taken very seriously. The shop supervisor may choose to revoke shop access upon the first violation depending on the severity. First time offenses will result in a written warning and may warrant a reduction of shop privileges. Serious violations or repeated offenses may result in termination of privileges. All serious violations will be reported to Environmental Health Services (EHS) and a decision will be made on the consequences after consultation with the department head, shop supervisor and dean of the college. Violations may be escalated to the VP or Office of General Council (OGC) if an agreement cannot be reached.

Toxic and Hazardous Substances

Properly dispose of toxic and hazardous substances. Never dispose of toxic or hazardous substances in sinks or floor drains. See EHS Hazardous Waste Disposal requirements.

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.

MACHINE SHOP USE

Hours of Operation

Workshop hours will be posted and approved by the shop supervisor. Access to the shop may be limited during scheduled classes and trainings, staff vacation, university holidays or shop maintenance. Contact the shop supervisor for a detailed schedule and additional information. Access to the shop is a privilege, not a right, and may be revoked for failure to adhere to shop guidelines.

The “buddy system” policy is constantly enforced. You must have another adult present to work in the shop.

Labor and Materials Pricing

Deans, directors, department heads and shop supervisors will determine if there is a charge for using the shop. This charge may include professional guidance, basic tooling, and new equipment purchases for the shop. Unique tooling may need to be purchased separately. “Shop Use” consists on being on the shop premise even if no tools or machines are in use. Tracking and charges will be at the discretion of the department or college. Departments or colleges will determine the consequences if users default on their shop charges. Departments or colleges may also allow customers to request completion of work by the shop at their discretion. Departments or colleges may offer staff a price quote for work including labor and materials if requested.

Visitor Use

Any visiting user of the shop who is not certified by the 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.

Use of Materials

Each department or college will determine if each user of the shop must supply his or her own materials and if some materials can be purchased from the shop. Additionally, contracting the shop for certain jobs may include the cost of materials in a cost estimate.

Tool Checkout

Certain tools are available to checkout. Use the checkout to reserve a tool. Follow further guidelines for borrowing on the checkout form.

Project Storage

Short term storage and specific group storage may be 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 shop is not responsible for theft or damage done to any project.

Food and Drink

Food and drink are permitted in the shop, but not at the machines while working or when they are operating. Food and drink are not allowed when chemicals are in use. Please be respectful and clean up after yourself.

SECURITY

Security Cameras

The shop may have security cameras. This footage may be viewed or reviewed at any time to investigate incidents for criminal or worker's compensation reports. By signing the User Acknowledgment Form, you agree to these terms.

Key and Card Reader Access

Keys to the shop will only be provided to staff. Authorized students will be added to the card reader (if applicable) 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 building proctor. Access to the facility is a privilege and as such may be revoked if policies are breached.

MAINTENANCE / UPKEEP

Tool Upkeep

The 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. Specific machine training covers proper use of each tool and maintenance that is to be performed.

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

Recycling and Waste

The following by-products of the shop are recycled. Please put recyclables in the appropriate receptacles. If unsure of your material, please ask.

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.

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.
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 properly.
7. Do not over use compressed air. Do not blow air into the bearing surfaces, and do not scatter chips. Shop vacuums work 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.

CERTIFICATIONS AND TRAININGS

General Safety Training

Use of the shop is prohibited without completion of the General Safety Training. This training will cover the basic guidelines and policies of this document including safety, shop use, storage, and cleanliness. Machine shop staff may offer a group training on an as needed basis.

Machine Specific Trainings

General Shop Training is required to be in the shop 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.

STAFF MANAGEMENT

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.

Duties and Functions

The 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.

Proper Machine Use Training

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

GENERAL SAFETY TRAINING

- You are not allowed to 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.

- You are not allowed to work alone – always use the “buddy system”.**

At least two adults must be in the shop when power tools are being used. You must get permission from the Shop Supervisor for off-hours work.

- You are not allowed to use a machine when impaired - be sober and smart.**

Being under the influence of alcohol or drugs while using 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.

- 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. If it cannot be done safely don't start it.

- You are not allowed to wear open toe or open heel shoes - use closed-toe shoes.**

Sandals, flip-flops or other open-toe and open-heel shoes are strictly prohibited at all times. Tools, chips and fixtures are sharp, and often hot. Shoes will help protect your feet from injury. Flame retardant shoes are required when welding.

- You are not allowed to work without proper eye protection - always wear appropriate safety glasses, goggles, or face shields 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.

- You are not allowed to 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 the supervisor for appropriate attire.

- 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.

- 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.

- 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.

Never leave your work area disorganized – always clean up after yourself.

Before you leave your work site all tools must be cleaned and returned to their storage location, machines must be cleaned 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.

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 and in proper working condition 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.

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

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

Never leave broken or damaged tools or abnormal equipment unreported – always inform shop staff 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.

Never make any adjustments to a machine when it is in operation -always talk to shop staff for permission when adjustment is needed.

Make sure you are competent and have permission from shop staff to affect repairs. Ensure power is off, equipment is properly locked out and safety devices are in place.

Choose a workspace that is well lit.

Setup extra lights when necessary. Contact the shop staff to request additional permanent light fixtures where needed.

Emergency eyewash station locations identified and use explained.

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.

Fire Extinguishers and exits identified.

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.

Use the closest exit that leads away from the fire as a fire escape route. Review fire escape routes. Maintain a distance of at least 50 feet between yourself and the building and keep clear of emergency equipment and personnel. Report to the designated rally point (building proctor will know this location). Do not re-enter the building after a fire alarm has been triggered until cleared by the appropriate authority.

Electrical safety.

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. Do not daisy chain cords and make sure they don't cross escape routes or are routed through ceiling openings. Make sure extension cords are of the proper gauge/ current carrying capacity for the power tools or equipment used.

*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 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.

Safety violations.

Staff may choose to revoke shop access upon the first violation depending on the severity. First time offenses will result in a written warning and a reduction of privileges. Second time offenses will result in termination of privileges.

Food and drink.

Food and drink are permitted in the shop, but not at the machines while working or when they are operating. Food and drink are not allowed when chemicals are in use.

Date of Training: _____ Instructor: _____

I have received the General safety training as outlined above:

Print Name

Signature

DRILL PRESS SAFETY TRAINING

- General safety training completed**
- Additional personal protective equipment (PPE) required**
- Face Shield**
- Foam ear plugs**
- Other:**
- Correct RPM for diameter of drill bit and material will be discussed with shop staff.**
- Work must be held to the drill table using a vise or clamp.**
- Correct grind of drill bit for the material being drilled will be discussed with shop staff.**
- Proper cutting fluid for the material being drilled will be discussed with shop staff.**
- Ease up on drilling pressure as the drill starts to break through the bottom of the material.**
- Never use a dull or cracked drill; inspect the drill before using. If in doubt, check with a shop staff or replace the bit.**
- Do not drill with too much pressure.**
- Always try to support part on parallels or a backing board when drilling thru material.**
- 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.**
- Always clean drill shank and/or drill sleeve, and, spindle hole before mounting.**
- Remove taper shank tools from spindle or sleeve with a drill drift and hammer.**
- Never try to loosen the drill chuck while the power is on.**
- 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.**
- Never clean a machine while it is in motion. Remove chips with a brush, never by hand.**
- If drill binds in a hole, stop the machine and turn the spindle backwards by hand to release the bit.**
- When drilling a deep hole withdraw the drill bit frequently to clear chips and lubricate the bit.**
- Always remove the drill chuck key or the drill drift from the spindle immediately after using it.**
- Never try to stop the spindle with your hand. Let the spindle stop of its own accord after turning the power off.**
- Plexiglas and other brittle plastics can be difficult to drill. Ask the shop staff for advice on drill and coolant selection when drilling these materials.**
- Other Items covered:**

Date of Training: _____ Instructor: _____

I have received the Drill Press safety training as outlined above:

Print Name

Signature

LATHE SAFETY TRAINING

- General safety training completed
- Additional personal protective equipment (PPE) required
- Face Shield
- Foam ear plugs
- Other:
- Chuck, drive plate, or, faceplate must be securely tightened onto the lathe spindle.
- Do not use machine power to remove or install the chuck, drive plate, or faceplate.
- When inserting or removing work, move the tool bit a safe distance from the collet or chuck.
- Do not run the machine faster than the proper cutting speed – consult a speed and feed table to determine the best speed.
- 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.
- Always clamp the tool bit as short as possible in the tool holder to prevent it from breaking or chattering.
- Always make sure that the tool bit is sharp and has the proper clearance. Ask for assistance when making adjustments.
- 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.
- If work is turned between centers, make sure that proper adjustment is made between centers and that the tailstock is locked in place.
- If work is being turned between centers and expands due to heat generated from cutting, readjust centers to avoid excessive friction.
- 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.
- Set the tool bit on the centerline of your work to prevent work from climbing over tool or cutting above center and dragging.
- Don't cut work completely through when turning between centers.
- Remove chuck key from chuck immediately after using.
- Turn chuck or faceplate through by hand before turning on the power to be sure there is no binding or clearance problem.
- Stop the machine before taking measurements.
- Before cleaning the lathe remove tools from the tool post and tailstock.

Date of Training: _____ Instructor: _____

I have received the Lathe safety training as outlined above:

Print Name

Signature

MILLING MACHINE SAFETY TRAINING

- General safety training completed
- Additional personal protective equipment (PPE) required
- Face Shield
- Foam ear plugs
- Other:
- Work must be clamped securely in a vise and vise clamped tightly to the table, or, work must be clamped securely to the table.
- Do not take climb milling cuts unless working on a CNC milling machine, or as a finish pass of less than .005".
- Make sure cutter is rotating in the proper direction before cutting material.
- Before running machine rotate the spindle by hand to make sure it is clear for cutting.
- Make sure the power is off before changing cutters.
- Always use the proper cutting fluid for the material being cut.
- Never run the machine faster than the correct cutting speed.
- Make sure that the machine is fully stopped before taking any measurements.
- Always use cutters which are sharp and in good condition.
- Do not place anything on the milling machine table such as wrenches, hammers, or tools.
- Always stay at the machine while it is running.
- Do not take too heavy a cut or use too rapid a feed.
- Remove the collet tightening wrench immediately after using it.
- If at all feasible rig a guard or shield to prevent chips from hitting other people.
- Use the milling machine spindle brake to stop the spindle after the power has been turned off.
- Before cleaning the mill remove cutting tools from the spindle to avoid cutting yourself.

Date of Training: _____ Instructor: _____

I have received the Lathe safety training as outlined above:

Print Name

Signature

BAND SAW SAFETY TRAINING

- General safety training completed**
- Additional personal protective equipment (PPE) required**
- Face Shield**
- Foam ear plugs**
- Other:**
- The upper guide and guard should be set as close to the work as possible, at least within 1/8".**
- If the band breaks, immediately shut off the power and stand clear until the machine has stopped.**
- Examine blade before installing to see if it is cracked, do not install a cracked blade.**
- 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.**
- 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.**
- If the saw stalls in a cut, turn the power off and reverse the blade by hand to free it.**
- If coolant system is present, ensure that coolant tank is full before starting cut. Ensure that cutting fluid is flowing sufficiently.**
- 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.**

Date of Training: _____ Instructor: _____

I have received the Lathe safety training as outlined above:

Print Name

Signature

GRINDING SAFETY TRAINING

- General safety training completed**
- Additional personal protective equipment (PPE) required**
- Face Shield**
- Foam ear plugs**
- Other:**
- Special training is required before using the surface grinder. Ask shop staff to demonstrate proper use of this tool.**
- 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.**
- Tool rests on bench or pedestal grinders shall be set no more than 1/16" from the wheel.**
- 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.**
- 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.**
- Do not grind on side of wheel unless wheel is specifically designed for such use.**
- Do not use excessive pressure while grinding. Report to the shop staff immediately any cracked, broken or otherwise defective wheels.**
- Have the shop staff mount and balance new wheels.**
- 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.**
- Hold work securely while grinding, use the tool rest to support the work when off-hand grinding on bench or pedestal grinders.**
- Do not grind aluminum. Aluminum dust is explosive. Check with shop staff for safety instructions if aluminum must be ground.**
- If a magnetic chuck is being used on the surface grinder, make sure it is holding the work securely before starting to grind.**
- 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.**

Date of Training: _____ Instructor: _____

I have received the Lathe safety training as outlined above:

Print Name

Signature

TABLE SAW SAFETY TRAINING

- General safety training completed**
- Additional personal protective equipment (PPE) required**
- Face Shield**
- Foam ear plugs**
- Other:**
- You may not operate a table saw without permission from the shop staff.**
- Inspect the blade before using it, to make sure it is the proper blade and is sharp and free from cracks.**
- Appropriate guards must be in place at all times. Never remove a guard. Ask shop staff for help if you think the guard is in the way.**
- 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.**
- The circular blade of the table saw should be set to 1/8 inch above the work.**
- Stand to one side, never directly in line with work being fed through the saw in the kick-back zone.**
- Never allow your fingers to get near the blade when sawing. Use a pusher stick to rip narrow pieces of stock.**
- Do not use a pusher stick to remove scrap. For scrap removal, shut off machine and wait until blade stops, then remove scraps.**
- 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.**
- 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.**
- Never reach over the saw to obtain something from the other side.**
- 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.**
- 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.**
- 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.**
- 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.**
- 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.**

Date of Training: _____ Instructor: _____

I have received the Lathe safety training as outlined above:

Print Name

Signature

POWER HAND (SKILL) SAW SAFETY TRAINING

- General safety training completed**
- Additional personal protective equipment (PPE) required**
- Face Shield**
- Foam ear plugs**
- Other:**
- Unplug the tool before making any adjustments.**
- 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.**
- Do not use the saw in a wet area.**
- Do not run the extension cord across walkways where people might trip over it or where the cord may be run over and damaged.**
- Keep your head out of the path of particles thrown out by the blade. Wear proper eye protection.**
- Wait until the saw stops before lifting it from a cut.**
- Disconnect the power cord before cleaning, changing blades, or making any adjustments to the saw.**
- When it is necessary to raise the guard for certain types of cuts, use the guard lever.**
- 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.**
- Before setting the saw down, make sure the guard is closed, as the blade may still be turning.**
- Do not carry the saw with your fingers on the switch trigger.**
- Do not pull the saw backwards in a cut if you can avoid it.**
- Use the proper blade for the type of cut to be made.**
- Do not use the cord to move or drag the saw.**
- 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.**
- Before cutting small work pieces shop personnel should be consulted.**
- Adjust the depth of cut 1/8" greater than the material thickness.**

Date of Training: _____ Instructor: _____

I have received the Lathe safety training as outlined above:

Print Name

Signature

DISC AND BELT SANDER SAFETY TRAINING

- General safety training completed**
- Additional personal protective equipment (PPE) required**
- Face Shield**
- Foam ear plugs**
- Other:**
- Do not operate sanders without the guards in place.**
- 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.**
- Always attempt to place your work against the rest on the disc and belt sanders.**
- On the horizontal belt sander, always sand so that the belt motion is away from you.**
- Do not operate machines with torn or ripped belts or disks.**
- 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.**

Date of Training: _____ Instructor: _____

I have received the Lathe safety training as outlined above:

Print Name

Signature

WELDING SAFETY TRAINING

- General safety training completed**
- Additional personal protective equipment (PPE) required**
- Face Shield**
- Foam ear plugs**
- Other:**
- Shop supervisor approval is required before using any welding equipment.**
- 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.**
- Do not weld while wearing polyester fiber clothing, as it is flammable.**
- The welder is responsible for erecting a screen around the welding area to protect other personnel in the shop from eye injury.**
- Inspect all welding equipment to be used for possible damage, prior to each use.**
- Avoid handling oxygen bottles with greasy hands, gloves or rags as it could result in a fatal explosion.**
- 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.**
- Do not arc weld in a wet area.**
- When arc welding, make sure work and/or work table is properly grounded.**
- 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.**
- Never weld in the same area where degreasing or other cleaning operations are performed.**
- Keep suitable fire extinguishing equipment nearby and know how to operate it.**
- 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.**
- 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.**
- Never weld inside drums or enclosed or confined spaces without adequate ventilation, or, the use of airline respirators or self-contained breathing apparatus.**
- Do not use any type of respirator without medical clearance, training and fit testing. You must contact your shop staff or Environmental Health Services in case you need a respirator.**
- 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.**
- Never cut or weld any container that has held explosive or flammable materials. Use prescribed methods for cleaning or flooding.**
- 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.**
- Abide by any other safety measures required for each particular type of welding.**
- Allow for proper ventilation when brazing or soldering. The fluxes are acidic and toxic.**

- 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.**
- Never regulate acetylene pressure higher than 15 PSI!**

Date of Training: _____ Instructor: _____

I have received the Lathe safety training as outlined above:

Print Name

Signature

HEAVY SANDING OF WOOD AND FOAM SAFETY TRAINING

- General safety training completed**
- Additional personal protective equipment (PPE) required**
- Face Shield**
- Foam ear plugs**
- Other:**
- Safety glasses must be worn when sanding.**
- Sand in a well-ventilated area away from other machines.**
- Use a vacuum or a dust collector to collect dust while sanding to prevent the dispersal over a large area.**
- 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.**

Date of Training: _____ Instructor: _____

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Print Name

Signature

