

SAFETY



Machine Shop Safety Guidelines

**University of California Santa Cruz
UCO/Lick Observatory – Mt. Hamilton
3 August 2009**

Machine Shop Safety Guidelines Training.doc
Machine Shop Safety Guidelines Training.pdf

SAFETY

Machine Shop Safety Guidelines

Table of Contents

Shop Safety, Hours, and Cleanup	3
General Shop Safety Rules	4
Drill Press Safety Rules	6
Lathe Safety Rules	8
Milling Machine Safety Rules	10
Grinding Safety Rules	11
Band Saw Safety Rules	12
Power Hand (Skill) Saw Safety Rules	13
Disc and Belt Sander Safety Rules	14
Welding Safety Rules	15
Safety Rules For Working with Solvents and Resins	17
Safety Rules For Heavy Sanding Of Wood and Foam	18

SAFETY

Shop Safety, Hours, and Cleanup

The first step in preventing personal injury or machine damage in the shop is to make sure that you are familiar with and know how to operate correctly the equipment you will be using. If you don't know ask your supervisor or the shop machinist.

How do accidents happen?

Accidents are caused by inattention, taking chances, horseplay, bad judgment, fatigue, uncooperativeness, improper clothing, defective tools, etc.

How do we help to avoid accidents?

By strictly following the safety rules given in the following pages and **by cooperating with, and following any additional instructions**, your supervisor or the shop machinist might have.

Please read over this manual carefully and follow the rules described.

If you have any questions about the operation of any machine or tool ask your supervisor or the shop machinist for instructions.

Shop Hours:

- A. Regular hours: M-F 8-5. Access to the machine shop may be limited during weekends and scheduled holidays.
- B. With permission Telescope Techs and other staff may use shop providing the following rules are observed.
 1. Persons wishing to use the shop after hours must check in with the supervisor or the shop machinist before 5:00pm to get access tool boxes and supplies.
 2. The shop may be used on weekends by qualified staff and qualified astronomers with special permission.

Shop Cleanup:

All persons working in the shop must clean up the shop area and equipment they were using when done! No Exceptions!

SAFETY

General Shop Safety Rules

1. Safety glasses, cover goggles, or face shields are required when in any shop area, whether working or not!!
2. Shoes must be worn in any shop area. No one **wearing sandals** will be allowed to enter any shop area. The minimum footwear must cover the entire foot.
3. Do not operate any item of equipment unless you are familiar with its operation and have been authorized to operate it. If you have any questions regarding the use of equipment ask the area supervisor or shop machinist.
4. Avoid excessive use compressed air to blow dirt or chips from machinery to avoid scattering chips. Never use compressed air guns to clean clothing, hair, or aim at another person.
5. In case of injury, no matter how slight, report it to the shop supervisor. The mountain emergency phone number is 5-911.
6. Do not attempt to remove foreign objects from the eye or body. Report to the supervisor or to the mountain police officer. If chemicals get in the eye(s), wash eye(s) for 15 minutes in an open flow of water before proceeding for medical treatment. Notify your supervisor or the mountain police officer.
7. Machines must be shut off when cleaning, repairing, or oiling.
8. Do not wear ties, loose clothing, jewelry, gloves, etc. around moving or rotating machinery. Long hair must be tied back or covered to keep it away from moving machinery. Hand protection in the form of suitable gloves should be used for handling hot objects, glass or sharp-edged items.
9. Wear appropriate clothing for the job (i.e. do not wear short sleeve shirts or short pants when welding).
10. Do not work in the shop if tired, or in a hurry.
11. Never indulge in horseplay in the shop areas.
12. All machines must be operated with all required guards and shields in place.

SAFETY

13. A brush, hook, or special tool is preferred for removal of chips, shavings, etc. from the work area. Never use the hands.
14. Keep fingers clear of the point of operation of machines by using special tools or devices, such as, push sticks, hooks, pliers, etc. Never use a rag near moving machinery.
15. A hard hammer should not be used to strike a hardened tool or any machine part. Use a soft faced hammer.
16. Practice cleanliness and orderliness in the shop areas.
17. Keep the floor around machines clean, dry and free from trip hazards. Do not allow chips to accumulate.
18. Think through the entire job before starting.
19. Before starting a machine, always check it for correct setup and always check to see if machine is clear by operating it manually, if possible.
20. Do not drink alcoholic beverages before or during work in the machine shop area. Do not bring food/snacks into the shop.
21. Don't rush or take chances. Obey all safety rules.
22. If you have not worked with a particular material before, check the hazardous materials data sheets book for any specific precautions to be taken while working with the material. Also, ask the shop personnel before cutting any unusual material.
23. Heavy sanding and painting should only be done in well ventilated areas, preferably outside.
24. Follow all appropriate precautions when working with solvents, paints, adhesives or other chemicals. Use appropriate protective equipment.
25. Check the power cords and plugs on portable tools for before using them.
26. Always store oily rags in an approved metal container.

SAFETY

Drill Press Safety Rules

1. Run drill at correct RPM for diameter of drill bit and material. Ask shop personnel for the correct RPM.
2. **Always** hold work in a vise or clamp to the drill table.
3. Use a correctly ground drill bit for the material being drilled. Shop personnel can help select the correct bit.
4. Use the proper cutting fluid for the material being drilled. Ask the shop staff about the appropriate fluid for the material you are machining.
5. Remove chips with a brush, NEVER by hand.
6. Ease up on drilling pressure as the drill starts to break through the bottom of the material.
7. Don't use a dull or cracked drill. Inspect the drill before using.
8. Don't drill with too much pressure.
9. Always try to support part on parallels or a backing board when drilling thru material.
10. **Never** place taper 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 in the event they fall onto the table.
15. **Never clean the machine while it is in motion!!**

SAFETY

16. If the drill binds in a hole, stop the machine and turn the spindle backwards by hand to release the bit.
17. **When drilling a deep hole withdraw the drill bit frequently to clear chips.**
18. **Always remove** the drill chuck key or the drill drift from the spindle **immediately after using.**
19. Wear safety eye protection while drilling.
20. Let the spindle stop of its own accord after turning the power off. **Never try to stop the spindle with your hand.**
21. Plexiglas and other brittle plastics can be difficult to drill. Ask the shop superintendent for advice on drill and coolant selection when drilling these materials.

SAFETY

Lathe Safety Rules

1. Make sure that the chuck or faceplate is securely tightened onto the lathe spindle.
2. When removing the chuck or faceplate **do not use machine power.**
3. When installing the chuck or faceplate **do not use machine power.**
4. Move the tool bit a safe distance from the collet or chuck when inserting or removing work.
5. Don't run the machine faster than the proper cutting speed.
6. In setting up the tool holder place it to the **left side of the compound slide** to prevent the compound slide from running into the chuck or spindle attachments.
7. Always clamp the toolbit as short as possible in the toolholder to prevent it from breaking or chattering.
8. Always make sure that the toolbit is sharp and has the proper clearance. Ask for assistance making adjustments.
9. If any filing is done on work revolving in the lathe, file left handed to prevent slipping into the chuck. **Never use a file without a handle.**
10. If work is turned between centers, make sure that proper adjustment is made between centers and that the tailstock is locked in place.
11. If work is being turned between centers and expands due to heat generated from cutting, readjust centers to avoid excessive friction.
12. **Do not** grasp or touch chips or turnings with your fingers, but get rid of them using a blunt instrument. It is safer to turn off the lathe before clearing chips then to leave it running.
13. Set the toolbit on center line of work to prevent work from climbing over tool or cutting above center and dragging.
14. Don't cut work completely through when turning between centers.
15. **Remove chuck key from chuck immediately after using.**

SAFETY

16. Turn chuck or faceplate through by hand before turning on the power to be sure there is no binding or clearance problem.
17. Stop the machine before taking measurements.
18. **Before cleaning** the lathe remove tools from the tool post and tailstock.

SAFETY

Milling Machine Safety Rules

1. Work must be clamped securely in a vise and vise clamped tightly to the table, or, work must be clamped securely to the table.
2. Do not take climb milling cuts on the shop's mills unless instructed to do so.
3. Make sure cutter is rotating in the proper direction before cutting material.
4. Before running machine the spindle should be rotated by hand to make sure it is clear for cutting.
5. Make sure the power is off before changing cutters.
6. Always use the proper cutting fluid for the material being cut.
7. Never run the machine faster than the correct cutting speed.
8. Make sure that the machine is fully stopped before taking any measurements.
9. Always use cutters which are sharp and in good condition.
10. Don't place anything on the milling machine table such as wrenches, hammers, or tools.
11. Always stay at the machine while it is running.
12. Don't take too heavy a cut or use too rapid a feed.
13. **Remove the collet tightening wrench immediately after using it.**
14. If at all feasible rig a guard or shield to prevent chips from hitting other people.
15. Use the milling machine spindle brake to stop the spindle after the power has been turned off.
16. **Before cleaning** the mill remove cutting tools from the spindle to avoid cutting yourself.

SAFETY

Grinding Safety Rules

1. Abrasive wheel machinery shall not be operated without the appropriate guards in place.
2. Toolrests on bench or pedestal grinders shall be set no more than **1/8 inch** from the wheel.
3. 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.
4. **Stand to one side when starting machine.**
5. Do not grind on side of wheel unless wheel is specifically designed for such use.
6. Do not use excessive pressure while grinding. On surface grinder do not exceed .0005 inch downfeed at any time.
7. Report to the area supervisor immediately any cracked, broken or otherwise defective wheels.
8. Have the area supervisor mount and balance new wheels.
9. 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.
10. Hold work securely while grinding, use the toolrest to support the work when off-hand grinding on bench or pedestal grinders.
11. Do not grind aluminum. Aluminum dust is explosive. Check with shop staff for safety instructions if aluminum must be ground.
12. Wear goggles over safety glasses when grinding on bench or pedestal grinders.
13. If a magnetic chuck is being used, on the surface grinder, make sure it is holding the work securely before starting to grind.

SAFETY

Band Saw Safety Rules

1. The upper guide and guard should be set as close to the work as possible, at least within **1/4 inch**.
2. If the band breaks, immediately shut off the power and stand clear until the machine has stopped.
3. Examine blade before installing to see if it is cracked, do not install a cracked blade.
4. 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.
5. **Do not run** the band saw at a higher speed than recommended for the material being cut.
6. If the saw stalls in a cut, turn the power off and reverse the blade by hand to free it.

SAFETY

Power Hand (Skill) Saw Safety Rules

1. 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.
2. Do not use the saw in a wet area.
3. Do not run the extension cord across walkways where people might trip over it or where the cord may be run over and damaged.
4. Keep your head out of the path of particles thrown out by the blade. Wear eye protection.
5. Disconnect the power cord before cleaning, changing blades, or making any adjustments to the saw.
6. When it is necessary to raise the guard for certain types of cuts, use the guard lever.
7. **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!!!**
8. Wait until the saw stops before lifting it from a cut.
9. Before setting the saw down, make sure the guard is closed, as the blade may still be turning.
10. Don't carry the saw with your fingers on the switch trigger.
11. Don't pull the saw backwards in a cut if you can avoid it.
12. Use the proper blade for the type of cut to be made.
13. Do not use the cord to move or drag the saw.
14. 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 for some kinds of work and often faster.
15. Before cutting small work pieces shop personnel should be consulted.

SAFETY

Disc and Belt Sander Safety Rules

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

SAFETY

Welding Safety Rules

Shop staff approval is required before using any welding equipment.

1. Welders, assistants, and anyone else in the welding area shall wear glasses or shields of recommended shades during welding operations.
2. A screen shall be erected around the welding area to protect other personnel in the shop from injury.
3. Inspect all welding equipment to be used, prior to each use, for possible damage.
4. Avoid handling oxygen bottles with greasy hands, gloves or rags. Fatal explosions have resulted from this cause.
5. 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.
6. When arc welding, make sure work and/or work table is properly grounded.
7. Do not arc weld in a wet area.
8. 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.**
9. Never weld in the same area where degreasing or other cleaning operations are performed.
10. Keep suitable fire extinguishing equipment nearby and know how to operate it.
11. 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.
12. 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.
13. Never weld inside drums or enclosed spaces without adequate ventilation, or, the use of airline respirators or self-contained breathing apparatus.

SAFETY

14. 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 or optics area.**
15. Never cut or weld any container that has held explosive or flammable materials. Use prescribed methods for cleaning or flooding.
16. 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.
17. Abide by any other safety measures required for each particular type of welding.
18. Allow for proper ventilation when brazing or soldering. The fluxes are acidic and toxic.
19. 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.
20. Do not weld in areas where smoke detectors or halon fire prevention systems are in place without contacting the Mt. Hamilton fire chief or maintenance supervisor for temporarily disabling of the alarm system in the area you are working. You must notify the person who disabled the alarm when you are finished in the area for the day.

SAFETY

Safety Rules for Working with Solvents and Resins

1. Avoid skin contact. Wear latex gloves.
2. Work in a well ventilated area. When respirators are necessary your supervisor can give you the necessary paperwork for an exam at the Student Health Center and a respirator fitting at EH&S.
3. Avoid using solvents around hot metal surfaces and flames.
4. Do not smoke or light flames in areas where solvents are used and stored.
5. Report and clean up any spills immediately. Call Maintenance Supervisor at 95934 to report the spill.
6. Do not work with solvents in confined, unventilated areas.
7. Do not drink alcoholic beverages or take medications containing alcohol before or during working with solvents. Alcohol in the bloodstream sometimes causes synergistic reactions with various solvents that can lead to loss of consciousness, and even possibly, death.
8. Report any ill effects and skin disorders to the your supervisor.
9. Develop and maintain good personal hygiene habits. Remove protective equipment and wash thoroughly after contact with solvents.
10. Fumes from paints, solvents, adhesives, and the abrasive cut-off saw used on the patio can drift into the shop. Work with staff to minimize these problems.
11. Mix resins in small batches.

SAFETY

Safety Rules for Heavy Sanding of Wood and Foam

1. Sand in a well ventilated area; away from other machines (preferably outside).
2. Use a vacuum or a dust collector to collect dust while sanding to prevent the dispersal over a large area.
3. A dust mask must be worn. They are stored in the safety cabinet.
4. Safety glasses must be worn.