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EYE PROTECTION and Direct Supervision of Students by Shop Staff or Physics Faculty Members is ALWAYS REQUIRED in the Physics Shop!

Shop Safety Guide
August 5, 2013
Basic Rules of the Physics Model Shop

1. Never work alone.
   
   *At least two adults must be in the shop when power tools are being used.*

2. Never work when you are impaired.
   
   *This includes when you are too tired, stressed or hurried to work carefully.*

3. If you cannot do a job safely in this shop, don’t do it.
   
   *There are limits to what we can build here.*

4. Always wear closed-toe shoes in the shop.
   
   *Tools, chips and fixtures are sharp, and often hot. Shoes will help protect your feet from injury. Leather shoes are preferred when welding.*

5. Eye protection is essential. Always wear safety glasses when working or cleaning tools.
   
   *Prescription glasses sold in the US with plastic lenses meet ANSI Standard Z87.1 for safety.*

6. Remove or secure anything that might get caught in moving machinery.
   
   *Rings, necklaces, long hair and loose clothes that get caught in tools can drag you along.*

7. Keep your hands away from sharp tools.
   
   *Make sure that nothing that you do will cause you to be cut.*

8. Dust, chemicals and smoke can be dangerous – work in well-ventilated areas, minimize contamination and use appropriate protective equipment.

9. If you’re unsure about the safe operation of a tool or any aspect of a job – ask for help!
   
   *Have shop staff check you out on a tool the first time you use one with which you are unfamiliar.*

10. Clean up after yourself.
    
    *Before you leave the shop each day all tools must be returned to the toolbox, the machine cleaned and wiped down and the floor swept. Leave 10-15 minutes for cleanup.*
Information about the Shop

The Instrument and Model Shop is available to all Physics and Engineering Physics students, staff and faculty working on University projects. Everyone must read this safety handout before using the tools in the shop.

The goal of this handout is to summarize the risks that are inherent in metalworking and to provide some guidelines for working safely. It is not intended to be a machining training manual. There are several good books in the library and references on the web. The first step in preventing personal injury or machine damage is to make sure that you know how to operate the equipment you will be using correctly. If you are unsure – Ask!

Because it is a communal area, used by many people, it is important to keep the shop clean and orderly. This means that every user must clean the machines and work areas they use, and put away all tools and material before leaving the shop.

Inattention, hurried work, horseplay, bad judgment, fatigue, improper clothing, defective tools, and poorly secured work pieces cause most accidents. Avoid accidents by following all of the rules in this handout and asking for help if you are unsure about the safest approach.

Disregarding shop rules, working unsafely or leaving a mess will result in suspension of shop privileges.

In an Emergency:
Call 9-911 or x-2222 from the shop phone, or (718) 817-2222 from a cell phone. The shop is in Freeman Hall, Room B-05. This is in the basement and is reached through either the front or rear entrances to Freeman Hall.

Shop Hours:
Regular hours: M-F 8:30-12:00, 1:00-4:00. Access to the shop may be limited during scheduled classes, and holidays.

Sign-in Book:
All users must sign in before beginning work! The sign in book is on the table of the Shop’s meeting area, directly inside the doors.
General Safety Guidelines

1. Do not attempt to remove foreign objects from the eye or body. Contact The Security Dept. at x-2222 and Report to Student Health Services for medical treatment. 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 Campus Security at x-2222.**

2. Avoid excessive use of compressed air to blow dirt or chips from machinery to avoid scattering chips. Never use compressed air guns to clean clothing, hair, or aim the gun at another person.

3. Machines **must be shut off** when cleaning, repairing, or oiling.

4. 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.

5. Wear appropriate clothing for the job (i.e. do not wear short sleeve shirts or short pants when welding).

6. Do not work in the shop if you are tired or in a hurry – this almost always ruins the work, and often results in injury.

7. Never indulge in horseplay in the shop areas.

8. All machines must be operated with all required guards and shields in place.

9. A brush, hook, or special tool is preferred for removal of chips, shavings, etc. from the work area. **Never** use your hands to clean cuttings – they are sharp!

10. Keep your 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.**

11. A hard hammer should not be used to strike a hardened tool or any machine part. Use a soft-faced hammer.

12. Keep the floor around machines clean, dry and free from trip hazards. Do not allow chips to accumulate.

13. **Think through the entire job before starting.** Ask for help if you have questions.

14. 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.

15. Do not drink alcoholic beverages before or during work in the machine shop area. Do not bring food or snacks into the shop.

16. If you have not worked with a particular material before, check for any specific precautions to be taken while working with the material. Also, ask the shop personnel before cutting any unusual material.

17. Heavy sanding, grinding and/or painting should only be done in well-ventilated areas.

18. Follow all appropriate precautions when working with solvents, paints, adhesives or other chemicals. Always use appropriate protective equipment.

19. Check the power cords and plugs on portable tools for before using them.

20. Always store oily rags in an approved metal container.
**Soldering Safety Guidelines**

To stay as safe as possible, always follow these safety guidelines when soldering:

1. **Always** wear safety glasses when soldering.
2. Never solder a live circuit (one that is energized).
3. Soldering irons come in models that use different wattages. Use the right size soldering iron for your projects; too much heat can ruin your board or components.
4. Solder in a well-ventilated space to prevent the mildly caustic and toxic fumes from building up and causing eye or throat irritation.
5. Always put your soldering iron back in its stand when not in use. Be sure that the stand is weighted enough or attached to your worktable so that it doesn’t topple over if you brush against the cord.
6. **Never** place a hot soldering iron on your work surface: You could start a fire.
7. Never, **ever** try to catch a hot soldering iron if you drop it. Let it fall, buy a new one if you have to — just don’t grab it!
8. Give any soldered surface a minute or two to cool down before you touch it.
9. Never leave flammable items (such as paper) near your soldering iron.
10. Be sure to unplug your soldering iron when you’re not around.
Drill Press Safety Guidelines

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 should they fall onto the table.
15. **Never clean a machine while it is in motion!!**
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 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. Let the spindle stop of its own accord after turning the power off. **Never try to stop the spindle with your hand.**
21. Plexiglass and other brittle plastics can be difficult to drill. Ask the shop staff for advice on drill and coolant selection when drilling these materials.
Lathe Safety Guidelines

1. Make sure that the chuck, driveplate or faceplate is securely tightened onto the lathe spindle.
2. When removing the chuck, driveplate, or faceplate do not use machine power.
3. When installing the chuck, driveplate, 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 – consult a speed and feed table to determine the best 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 tool bit as short as possible in the tool holder to prevent it from breaking or chattering.
8. Always make sure that the tool bit 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 tool bit on the centerline of your 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.
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.
Milling Machine Safety Guidelines

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 mill 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, use 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.
Band Saw Safety Guidelines

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. **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.
6. If the saw stalls in a cut, turn the power off and reverse the blade by hand to free it.

Grinding Safety Guidelines

1. Special training is required before using the surface grinder. Ask shop staff to demonstrate proper use of this tool.
2. Abrasive wheel machinery shall not be operated without the appropriate guards in place.
3. Tool rests on bench or pedestal grinders shall be set no more than 1/16 inch from the wheel.
4. 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.
5. **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.
6. Do not grind on side of wheel unless wheel is specifically designed for such use.
7. Do not use excessive pressure while grinding. On surface grinder do not exceed .0005 inch downfeed at any time.
8. Report to the area supervisor immediately any cracked, broken or otherwise defective wheels.
9. Have the area supervisor mount and balance new wheels.
10. Keep the grinding wheel dressed. Dressing a small amount frequently is better than having to dress a lot later and will allow the wheel to cut faster, cooler and with a better surface finish. Dressing is cleaning and smoothing the surface of the grinding wheel.
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. Wear goggles over safety glasses when grinding on bench or pedestal grinders.
August 5, 2013

Power Hand (Skill) Saw Safety Guidelines

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

Disc and Belt Sander Safety Guidelines

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 Guidelines for Working with Solvents, Chemicals
1. Learn about the chemicals that you are planning to use before opening them. Read the instructions and MSDS sheet. Consult shop staff or Security/Safety if you have any questions.
2. Use water-based cleaners instead of solvents where possible.
3. Avoid skin contact. Wear latex gloves.
4. Work in a well ventilated area or a fume hood if possible.
5. Do not use solvents around hot metal surfaces and flames.
6. Do not smoke or light flames in areas where solvents are used and stored.
8. Do not pour any chemicals down the drain. Waste containers must be used.
9. Only use solvents in well ventilated areas - do not work with them in confined areas.
10. 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.
11. Report any ill effects and skin disorders to the area supervisor.
12. Develop and maintain good personal hygiene habits. Remove protective equipment and wash thoroughly after contact with solvents.

Safety Guidelines for Heavy Sanding of Wood and Foam
1. Sand in a well ventilated areas away from other machines.
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 may be worn if desired, inquire with shop staff.
4. Safety glasses must be worn when sanding.

Guidelines for Cleaning
1. Turn off power to the machine before cleaning. This will avoid accidentally starting the machine and injuring yourself.
2. Remove cutting tools. Take out drill bits, mills and remove lathe tools to reduce the chances of getting cut.
3. Put away all hand tools and other items around the tool so that you don’t make them dirtier.
4. Clean chips from the tool, the chip pans. Recycle clean chips where possible.
5. Put a light coat of way oil on the machine ways. Ask staff to demonstrate.
6. Sweep the floor in the area where you have been working.
7. Do not over use compressed air. Do not blow air into the bearing surfaces, and do not scatter chips all over the shop. Sometimes a shop vacuum works better than the air gun.
8. Report missing, broken or damaged tools to shop staff.
9. Spend five minutes on general cleaning around the shop. We’re all in this together.