Safety Manual for the Armstrong Machine Shops AR-112 AR-127

The College of New Jersey School of Engineering 10 December 2004

revised 14 Jan 2016

Table of Contents

SHOP SAFETY

The first step in preventing personal injury in a machine shop is to make sure that you are familiar with and know how to operate the equipment you will be using. If you are not sure if a machine is operating properly, shut it off and ask the Area Supervisor.

Attending a Safety Lecture or reading the Safety Manual, passing the Safety Test, and reading Equipment Safety Rules ONLY give you permission to access the shops. YOU MUST ADDITIONALLY RECEIVE INSTRUCTION FROM AN AREA SUPERVISOR IN ORDER TO OPERATE ANY EQUIPMENT. The Safety Lecture and Test must be repeated every year. When you pass the Safety Test you will be added to the Authorized Machine Shop Access List. In order to utilize any equipment, you need to complete an instruction session with the Area Supervisor who will add your name to a list specific to each piece of machinery. Under no circumstances are you to use equipment prior to this specific use training.

Most accidents are caused by rushing, also inattention, improper use of tools, horseplay, bad judgment, fatigue, uncooperativeness, improper clothing, defective tools, etc. Accidents can be minimized by strictly following the safety rules given in the following pages and by cooperating with, and following any additional instructions, the Area Supervisor might have.

If you violate any safety rule you will lose your machine shop access privileges. On the first offense for one day, second offense for one week, third offense for the school year.

SHOP HOURS

1. Regular hours for all shops are posted on the TVs in the hallways in Armstrong Hall.
2. Access to the machine shop may be limited during scheduled classes, vacations, and holidays.
3. The shops may be used only with faculty or on duty staff supervision.

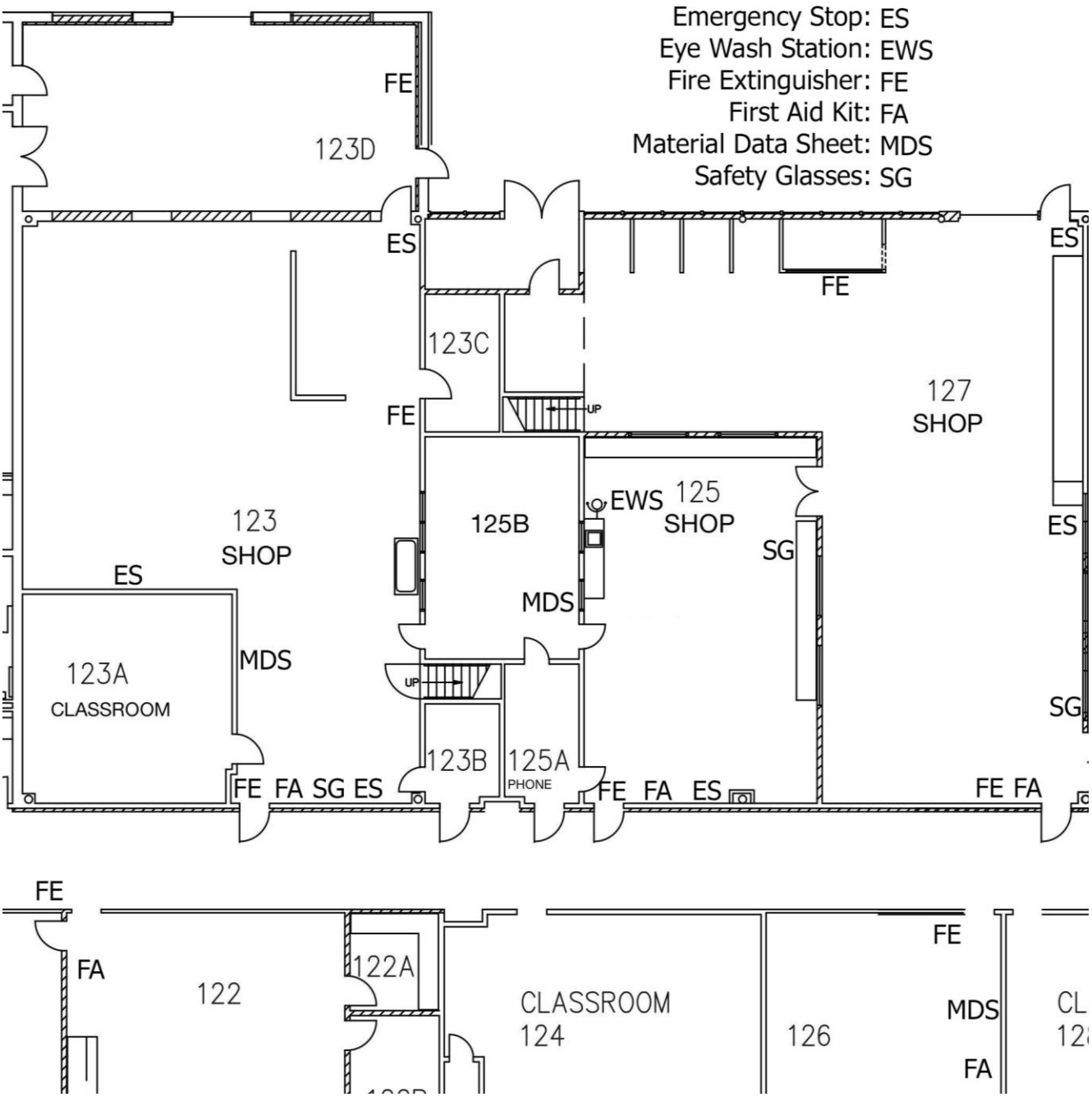
SHOP PHONES

The shop phones are located in AR-125A (x3344) on the desk and in AR-112 (x2086) near the Faculty Storage Area AR112A.

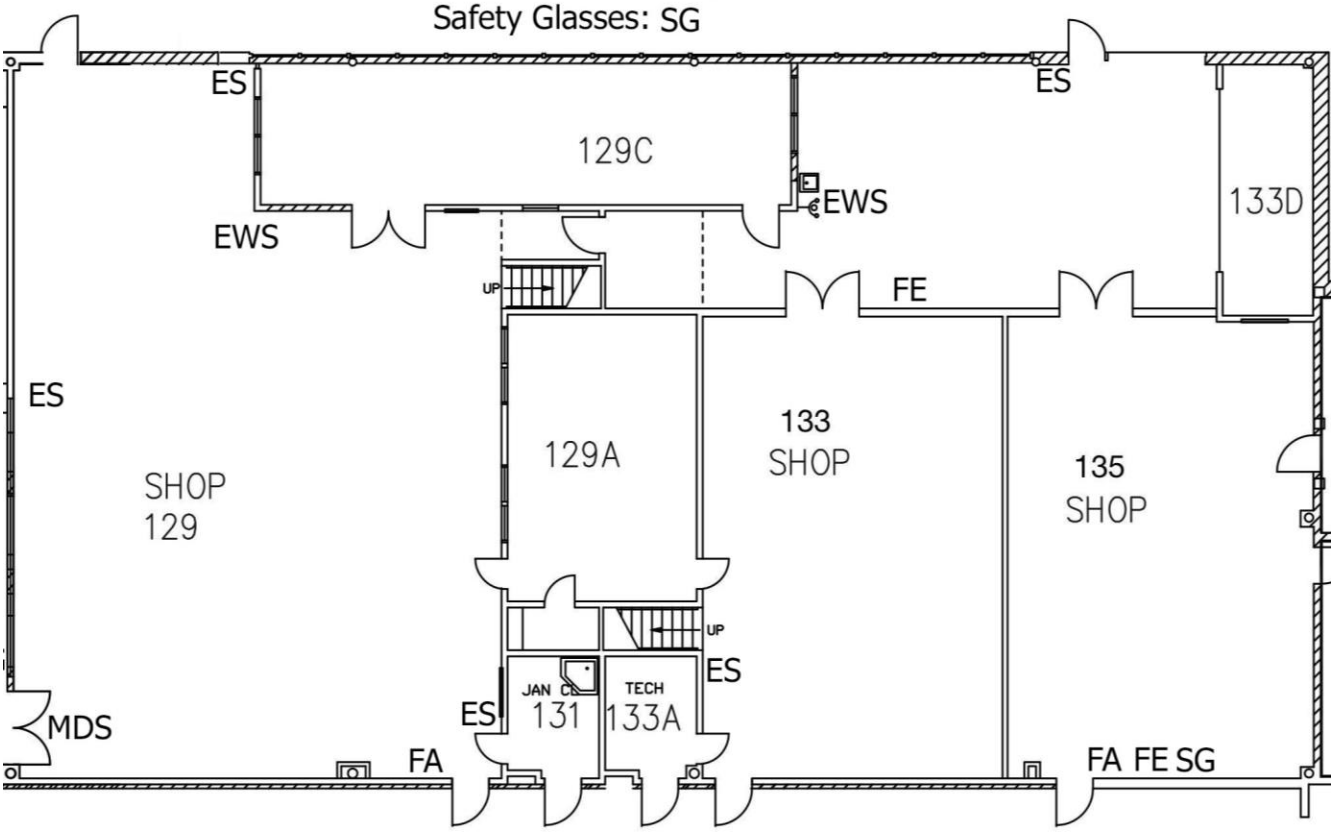
SHOP WORK

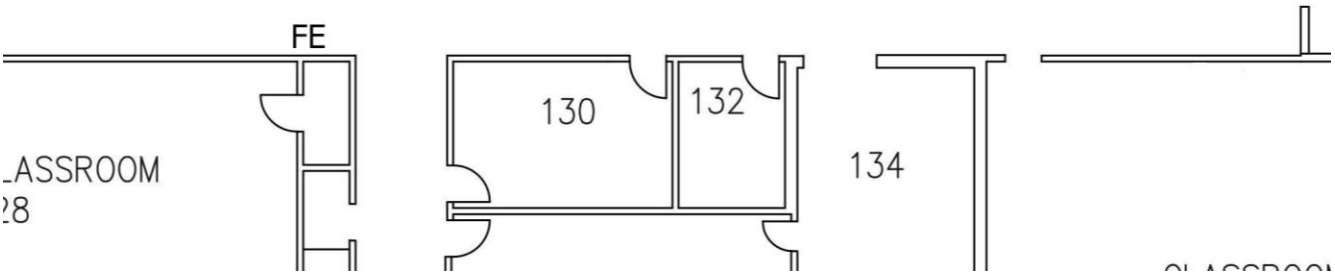
Shop activities are limited to School of Engineering educational endeavors only. Students are not permitted to use School of Engineering resources for personal or non-educational purposes. Extra-curricular shop activities are only permitted by special requests to faculty members if:

1. Resources are available, and the activity doesn't interfere with curricular activity
2. Student describes in writing a detailed plan for the project including educational merit
3. Faculty member signs off on the project
4. Any consumable materials are provided by the student at their own expense

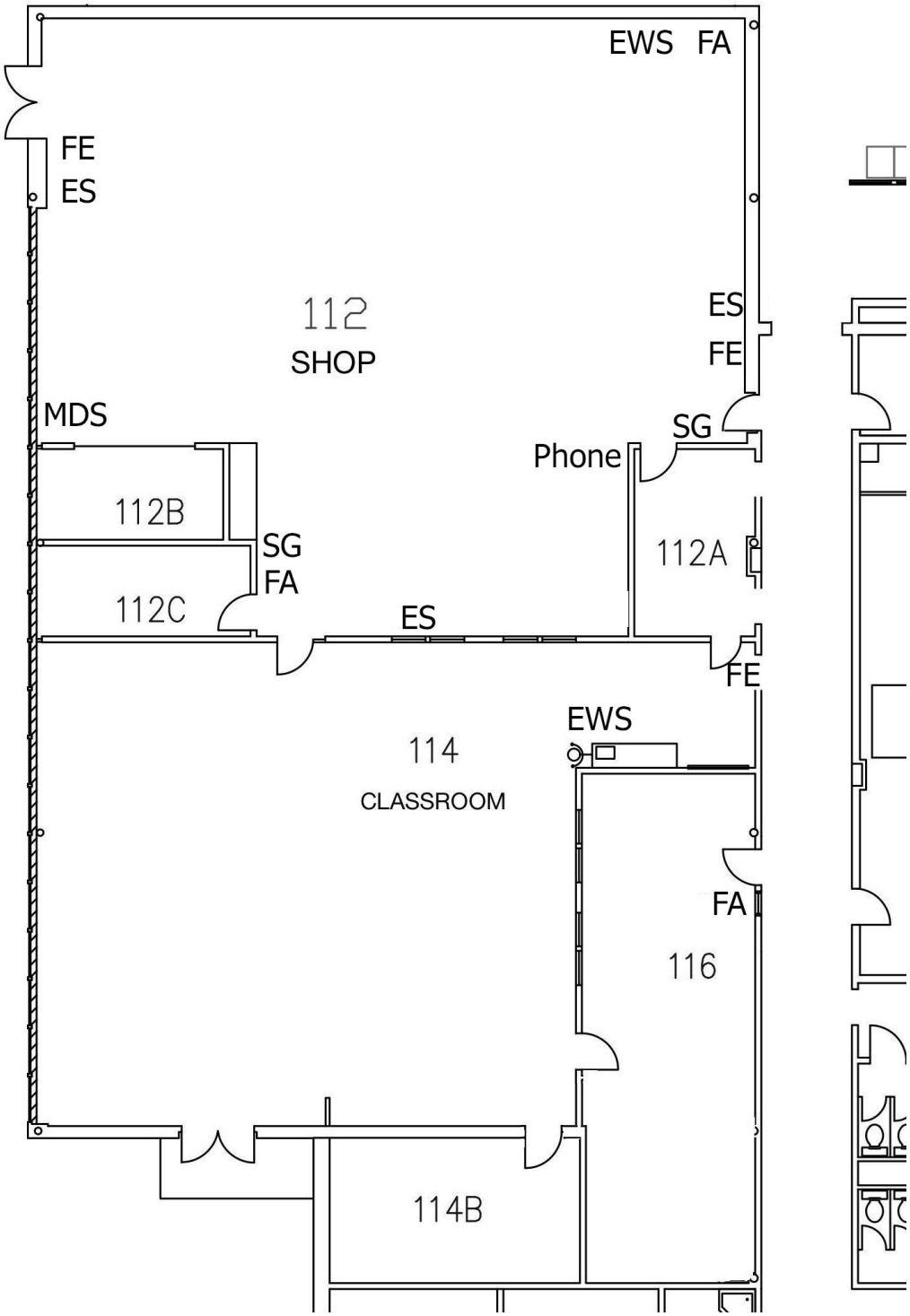

Emergency Stop: ES
Eye Wash Station: EWS
Fire Extinguisher: FE
First Aid Kit: FA
Material Data Sheet: MDS
Safety Glasses: SG
123D
FE
ES
123C
FE
UP
127
SHOP
ES
FE
125
SHOP
EWS
125B
123
SHOP
ES
SG
MDS
123A
CLASSROOM
MDS
UP
ES
SG
123B
125A
PHONE
FE FA SG ES
FE FA ES
FE FA
FE
FA
122
122A
CLASSROOM
124
126
FE
MDS
FA

Emergency Stop: ES
Eye Wash Station: EWS
Fire Extinguisher: FE
First Aid Kit: FA
Material Data Sheet: MDS
Safety Glasses: SG





Emergency Stop: ES
Eye Wash Station: EWS
Fire Extinguisher: FE
First Aid Kit: FA
Material Data Sheet: MDS
Safety Glasses: SG



GENERAL SHOP SAFETY RULES

1. Safety glasses, cover goggles, or face shields are required at all times in all shop areas. Your eyes are very fragile. Contact lenses are not recommended because of chemical interactions.

2. No one wearing open toed shoes, high heels, or platform shoes should enter any shop area. The minimum footwear must cover the entire foot.

3. Do not operate any item of equipment unless you have been trained in its operation. If you misuse or abuse our tools they will break!

4. Do not consume reality altering substances before or during work in the shop. **Do not bring food, snacks, or drinks of any kind into any shop area**.

5. Avoid use of compressed air to blow dirt or chips from machinery. It makes a mess. Never use compressed air guns to clean clothing, or hair. Never aim a compressed air gun at another person.

6. A brush, hook, or special tool is preferred for removal of chips, shavings, etc. from the work area. Never use your hands. Avoid using an Air Gun!

7. 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.

8. In case of injury report it to an Area Supervisor and Human Resources x3306 or x2283. In case of an emergency call 911 from the shop phone or (609) 771-2345 from a Cel Phone. First Aid is available from Student Health Services, 107 Eickhoff Hall (609) 771-2483. Do not attempt to clean up blood. Facilities will clean up any blood.

9. Do not attempt to remove foreign objects from the eye or body before seeking medical treatment. If chemicals get in the eye(s), wash eye(s) for 15 minutes in the Eye Wash Station before proceeding for medical treatment. The Eye Wash Stations are located in AR-129, AR-125, AR125B, AR-114 and AR-112.

10. Machines must be shut off and at rest when cleaning or adjusting.

11. Do not wear ties, lanyards, hoodies with strings, loose clothing, jewelry, gloves, etc. around machinery. Long hair must be tied back or covered. Hand protection in the form of suitable gloves should only be used for handling hot objects, glass or sharp-edged items.

12. Wear appropriate clothing for the job (i.e. do not wear short sleeve shirts, short pants, or non-leather sneakers when welding). Leave your coats, backpacks, etc. outside the work area.

13. Do not work in the shop if you are in a hurry or tired.

14. Never indulge in horseplay in the shop areas. Or bring unnecessary items into the shop.

15. All machines must be operated with all provided guards and shields in place.

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

17. Do not block open any lab or shop door.

18. Keep the floor around machines clean, dry and free of trip hazards. Do not allow debris to accumulate around machines. Keep the shops tidy and clean. Put tools back where you found them.

19. Think through the entire job before starting. Make sure work piece is secure to prevent movement and damaging tooling.

20. Before starting a machine, always check it for correct setup and always check to see if the machine is clear by operating it manually, if possible.

21. No work may be performed in any shop using power tools unless at least two people are in the shop area and **can see each other**.

22. Don't rush or take shortcuts. Obey all safety rules. Avoid distractions while machining.

23. If you have not worked with a particular material before, check the Safety Data Sheets (SDS) book for any specific precautions to be taken while working with the material. Also, ask the Area Supervisor before cutting any unusual material.

24. Painting and grinding should only be done in well ventilated areas. Use dust masks or respirators when directed by the Area Supervisor.

25. Follow all appropriate precautions when working with solvents, paints, adhesives or other chemicals. Use appropriate protective equipment.

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

27. Always store oily rags in an approved metal container.

28. Know the location of the nearest Fire Extinguisher.

29. Respect the equipment in the shops, it does not respect you!

DRILL PRESS SAFETY RULES

1. Run drill at correct RPM for diameter of drill bit and material. Ask the Area Supervisor.

2. **Always** hold work in a vise or clamp the work to the drill table.

3. Use a correctly ground drill bit for the material being drilled. Ask the Area Supervisor.

4. Use the proper cutting fluid for the material being drilled. Ask the Area Supervisor.

5. Remove chips with a brush. **Never** by hand.

6. Ease up on drilling pressure as the drill starts to break through the work.

7. Don't use a dull or cracked drill. Inspect the drill before using.

8. Always try to support the work on parallels or a backing board when drilling thru material.

9. **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.

10. Always clean drill shank and/or drill sleeve, and, spindle hole before mounting.

11. Remove taper shank tools from spindle or sleeve with a drill drift and hammer.

12. **Never** try to loosen the drill chuck while the power is on.

13. 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.

14. **Never clean the Drill Press while it is in motion!!**

15. If the drill binds in a hole, stop the machine and turn the spindle backwards by hand to release the bit.

16. **When drilling a deep hole withdraw the drill bit frequently to clear chips**.

17. **Remove** the drill chuck key or the drill drift from the spindle **immediately after using.**

18. Let the spindle stop of its own accord. **Never try to stop the spindle with your hand.**

19. Plexiglas and other brittle plastics can be difficult to drill. Ask the Area Supervisor for advice on drill and coolant selection when drilling these materials.

LATHE SAFETY RULES

1. Make sure that the chuck, drive plate, or, faceplate is securely tightened onto the lathe spindle.

2. When removing the chuck, drive plate, or faceplate **do not use machine power.**

3. When installing the chuck, drive plate, 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. Run the machine at 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 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 tail stock 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 chip hook. It is safer to turn off the lathe before clearing chips.

13. Set the tool bit 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.**

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 tail stock.

MILLING MACHINE SAFETY RULES

1. Work must be clamped securely in a vise and the 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 rotate the spindle 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. Run the machine at 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 and use the proper feed speed.

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

GRINDING SAFETY RULES

1. Abrasive wheel machinery shall not be operated without the appropriate guards in place.

2. Tool rests 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 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.

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 tool rest to support the work when offhand grinding on bench or pedestal grinders.

11. **Do not grind aluminum**.

12. Wear goggles over safety glasses when grinding on bench or pedestal grinders.

BAND SAW SAFETY RULES

1. The upper guide should be set as close to the work as possible, at least within **1/4 inch.**

2. If the band breaks, 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.

HORIZONTAL BAND SAW SAFETY RULES

1. Clamp the work-piece firmly in the vise, but don't over tighten!

2. The vise jaws must be parallel. Use a spacer block when cutting short or odd shaped pieces to keep the jaws parallel.

3. Support the descent of the saw as it starts the cut, or for the entire cut when cutting thin stock or if the saw drops rapidly.

4. Use only the correct blade for the material being cut. (Fine blade for steel, coarser one for aluminum, plastic or wood.)

5. Adjust the blade guides and rollers properly, and adjust the speed. The leading saw guide should clear the jaws when it descends, but be as close to the jaws as possible.

6. Check the work-piece to be sure it is free of defects (i.e. broken off tool bits).

7. A minimum of three teeth must be engaged in the work-piece at all times or the teeth will be torn off of the blade.

8. Hold round stock securely with a “Vee block” in a vise.

9. The Horizontal Band saw is a flood coolant machine, the fluid that flows over the blade is recirculated. If the fluid is not flowing inform the Area Supervisor immediately and it will be refilled.

TABLE SAW SAFETY RULES

1. Never cut free between the fence and the blade

2. Stand to one side, never directly in line with, work being fed through the saw.

3. 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.

4. Inspect the blade before using it, to make sure it is the proper blade and is sharp and free from cracks.

5. **Never** allow your fingers to get near the blade when sawing. Use a pusher stick to rip narrow pieces of stock. Don't use pusher stick to remove scrap. For scrap removal, shut off machine and wait until blade stops, then remove scraps.

6. **Appropriate guards must be in place at all times.** Never remove the guard. Ask the Area Supervisor for help if you think the guard is in the way.

7. 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.

8. 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.

9. Never reach over the saw to obtain something from the other side.

10. 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.

11. 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.

12. 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.

13. Make sure that you clean up thoroughly around the saw before leaving the area. If you don't you could be the cause of someone else having an accident.

14. The circular blade of the table saw should be set **to 1/4 inch above the work**.

RADIAL ARM SAW SAFETY RULES

1. Unplug the machine before handling or changing the blade.

2. Select the proper blade for the cut to be made. Check the blade to be free of cracks or nicks, and that it is sharp.

3. Limit the blade extension to 1/4 inch beyond the piece being cut.

4. Use the ripping fence or the cutoff gauge when cutting material, but don't use both of them at the same time!

5. Cut the work piece at a moderate rate, but not so fast to slow down the motor.

6. You may not cut any work-piece on the radial arm saw that is less than 12 inches in length.

7. The radial arm saws are for cutting wood or plastic materials only!

SQUARING SHEAR SAFETY RULES

1. Keep fingers and measuring scales out of the way of the blade.

2. Do not cut round stock or anything except sheet metal in the shear!

3. Place the sheet against the guide and then clamp it in position with the clamp on the machine.

4. Don't jump up and down on the treadle. Operate with one foot, or stand on it and use the other foot to stomp the treadle down.

5. Return the treadle to the up position slowly with foot pressure. Do not let it make a rapid return.

6. Pick up the scrap pieces when you have completed cutting.

POWER BREAK SAFETY RULES

1. Bend only sheet stock in the brake. No round stock!

2. Adjust the clamping bar correctly to suit gauge of metal being formed, and stand clear of the moving part of the brake.

3. Keep fingers clear of the jaws of the brake.

HYDRAULIC PRESS SAFETY RULES

1. You must wear Safety Glasses AND a Face Shield when using or observing use of the Hydraulic Press.

2. Make certain the work is solidly supported on the table and is aligned with the ram. Unstable setups can fly apart with extreme force!

3. Don't stack spacers, blocks, etc. unless absolutely necessary.

4. Apply force on the part slowly while observing the setup.

5. Chamfer ends of shafts and holes so parts self align as they're pressed.

6. Lubricate all interference fits with High Pressure Lube, not oil.

7. Use a bearing puller to remove ball bearings.

8. Shield brittle materials a full 360 degrees (i.e. ball bearings without a bearing puller, hardened or brittle materials), to protect others.

9. Do not exceed the capacity of the Hydraulic Press. If it's not working easy, ask the Area Supervisor!

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.

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 the Area Supervisor should be consulted.

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.

SCROLL SAW SAFETY RULES

1. Do not operate the scroll saw without the guards in place.

2. Make all adjustments with the power off, then rotate the motor by hand as a final check.

3. Be sure hold down is pressing lightly on the work piece.

4. The blade should be held firmly in the chucks, be square with the table, and be properly supported by the guide assembly.

5. Guide the material slowly through the machine with both hands, keeping fingers away from the cut line.

6. Choose the correct blade and correct speed for the material to be cut, and for the smallest radius required.

WELDING SAFETY RULES

Area Supervisor 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.

3. Inspect all welding equipment to be used, prior to each use, for possible damage.

4. Never handle oxygen bottles with greasy hands, gloves or rags.

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.

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.**

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.

WORKING WITH SOLVENTS AND RESINS SAFETY RULES

1. Avoid skin contact. Wear latex gloves.

2. Work in a fume hood if possible.

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.

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 Area 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 can drift into the shop. Work with the Area Supervisor to minimize these problems.

11. Mix resins in small batches.

HEAVY SANDING OF WOOD AND FOAM SAFETY RULES

1. Sand is a well ventilated area; away from other machines (preferably outside).

2. Use a vacuum or a dust collector **while** sanding to prevent dust dispersal over a large area.

3. A dust mask should be worn.

VACUUM FORMING EQUIPMENT SAFETY RULES

1. Eye protection should be worn at all times.

2. Always wear protective gloves when operating the machine.

3. Fumes can be inhaled - This process should be carried out only in well ventilated areas.

4. Plastic Surfaces should be allowed to cool before handling.

5. Equipment should never be left unattended when plastics are being heated.

6. If you intend to use your mold to make or serve food, be sure that you use FDA-approved plastic.

INJECTION MOULDER SAFETY RULES

1. Eye protection should be worn at all times.

2. Molded Plastic parts should be allowed to cool before handling.

3. Do not leave the machine unattended while it is in use.

4. Fumes can be inhaled - This process should be carried out only in well ventilated areas.

HOT WIRE CUTTERS SAFETY RULES

1. Eye protection should be worn at all times.

2. Hot wire cutters should only be used to cut expanded polystyrene.

3. Contact with the hot wire cutter can cause skin burns.

4. Fumes can be inhaled - This process should be carried out only in well ventilated areas.