



# Washington University in St. Louis

McKelvey Student

Machine Shop

Safety Instruction Manual





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## *Safety Operating Procedures for Equipment*

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## **FOREWORD:**

This safety manual was created to provide effective and informative Shop Safety Information to the students of Washington University McKelvey School of Engineering Student Machine Shop. We recognize the necessity for a practical and applicable safety program, for the protection of our students. The cooperation of each student is required to make this program a success.

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tapellad@wustl.edu, Washington University McKelvey Student Machine Shop.

**TASK:** Describe required safety procedures and practices.

## **PURPOSE:**

Specific safety procedures and practices that are required use in the machine shop, not only because it makes good sense, but because Federal Law requires it. Most importantly, failure to observe safety rules and regulations can endanger you and those around you in the machines shop. In short, the machine shop can be a dangerous place. The importance of knowing and following good safety practices cannot be over-emphasized, because this is the only way the dangerous situations can be avoided.

## **PERFORMANCE OBJECTIVES:**

Students will develop an understanding of safety procedures and practices required in the machine shop, with the use of this manual. They will be able to apply these procedures and rules in the operation of all equipment present in the student machine shop. Access to the student machine shop will be suspended, when a student fails to abide by these procedures and practices that have been presented in this safety manual.

## *Procedures for Shop Use*

### *1. Safety Glasses:*

- Everyone must wear safety glasses in all areas of the shop!
- Safety glasses used in the student machine shop is a requirement of Washington University McKelvey School of Engineering, EH&S, and OSHA regulation [29 CFR 1910.133](#)
- Chips can be thrown beyond the footprint of the machine. Also if a compressed air line is used in the shop, you could be at risk of being hit by flying chips, from another area of the shop.

### *2. Student Shop Safety Procedures:*

- a) ***Never work alone*** – ***In the absence of professional staff, a trained student monitor must be physically present in the shop for any work to occur***
- b) ***Loose fitting clothing*** may not be worn in the shop, including ties, scarves, dresses, and loose fitting sweat shirts or hoodies with tassels, long sleeves are prohibited.
- c) ***Open-toed shoes*** (flip flops), ***Crocks, Clogs, and house shoes*** are prohibited.
- d) ***Short pants, skirts, and dresses*** are prohibited.
- e) ***Jackets*** are prohibited when operating equipment.
- f) ***Synthetic fabrics:*** It is highly recommended that the listed synthetic fabrics not be worn in the machine shop. These fabrics are vulnerable to hot chips, they have the potential of melting or catching the fabric on fire.
  - ***Spandex, Poly/spandex, Lycra (Elastane)***
  - ***Nylon*** • ***Acetate fabric*** • ***Polyester*** • ***Rayon*** • ***Polypropylene***

***Clothing items*** that use these materials are generally ***Leggings, jeggins, yoga pants, stirrup pants, nylon pants, and athleisure wear.***

- g) A person's ***torso*** and ***upper arms*** are required to be completely covered.
- h) ***Remove jewelry*** before beginning work, including rings, necklaces, bracelets, and watches.
- i) ***Long hair*** must be pulled back secured and contained in a bun.
- j) ***Long beards*** must also be contained.
- k) ***Aisles, exits, and access to emergency equipment*** must be kept clear at all times.
- l) ***Cell phones, mp3 players, ear buds, and other personal electronic devices*** must not be used when working at any machine. Music is prohibited.
- m) ***Food is prohibited in the shop, drinks*** are permitted in a designated area only.
- n) ***Approval*** to operate power equipment must be obtained thru online or in-person testing prior to use. Once approval to use equipment is obtained you will activate the equipment using Fabman.
- o) ***All guards and shields*** must be secured and in place prior to operating equipment.
- p) ***Compressed air*** must not be used to clean skin or clothing, or to clean off large amounts of chips off of equipment.
- q) ***Do not use damaged equipment,*** or equipment that does not appear to be operating normally. Tag it as out of service and report the issue immediately to the Supervisor.
- r) ***Immediately report all injuries,*** problems or concerns to the Supervisor, Police or Monitor.
- s) ***Horseplay*** is prohibited in the machine shop
- t) ***Supervisors and Monitors*** have full authority over the shop and its safe use, including the responsibility, authority, and obligation to prohibit shop or tool access for the safety of an individual, others in the shop, or the equipment.

If Procedures B, C, D, E, G, are not adhered to you may be asked to leave the shop and change your attire.

### **3. Guidelines for Shop Safety and Conduct:**

#### **a) INTRODUCTION TO SHOP SAFETY:**

Please read these safety guidelines carefully and follow the rules described. If you have any questions about the operation of any machine, tool, or process. Ask the area supervisor for instructions

**BEFORE USE.** The first steps in preventing personal injury or machine damage in a shop setting is:

- Make sure that you are familiar with and know how to correctly and safely operate the equipment you will be using.
- Be familiar with all processes and associated hazards that a job may entail.
- Understand the properties and hazards of all materials you will be working with, including personal protective equipment (PPE) needed to complete a job safely.
- Always be aware of your surroundings (be careful not to bump into other students while they are working on a piece of equipment)
- Listen to the machine you are using. If it doesn't sound right, turn the machine off, and report the problem.
- Do not attempt to measure a part that is moving.
- Don't let someone else talk you into doing something dangerous.
- Do not talk to someone while they are operating a machine.

There will be on horse play of any kind in the shop

#### **b) How do accidents happen?**

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

#### **c) USER RESPONSIBILITIES:**

- It is the individual user's responsibility to not engage in any behavior or activity he or she feels is unsafe or that could result in injury to themselves or others.
- Do not operate equipment or perform any procedures that you are not familiar with. Ask the area supervisor (instructor) for training or guidance so that you may complete your duties safely.
- Safety is the individual's responsibility. All users of the Washington University McKelvey Student Machine Shop, have the right to stop work if they believe they have not been properly trained to operate any piece of equipment, or to perform a procedure safely. This includes the providing of personal protective equipment.

#### **d) OPERATIONAL GUIDELINES:**

Do not work in the machine shop if tired, sick or in a hurry. No horseplay. Think through the entire job process before starting. Machines must be shut off when cleaning, repairing, or filling with oil. Follow lock-out procedures while maintenance is being performed.

#### **e) Mandatory Requirements for operating Machinery:**

Prior to operating machine shop equipment all requirements must be met, see requirements below.

- Machine shop Supervisor/Instructor, or Shop Monitor, must be present while operating machine shop equipment.
- User has completed the online proficiency and safety testing
- User has completed online training and testing for the equipment they intend to use
- User has passed the in-person test for the equipment they intend to use
- User has received their Fabman membership information
- User is knowledgeable of machining processes

#### **4. Machining Guidelines:**

- Know the capabilities of the machine you are using.
- Check your part to make sure that it is secure in the vice, 3 jaw chuck, etc.
- **Never leave a machine running unattended.**
- Never use a file without a handle. Files have a tapered tang that could be jabbed into, or thru your hand.
- When using a Jacobs chuck or a 3 jaw chuck, be sure to remove the chuck key before turning the machine on.
- Special setups must be approved by the Shop Manager, before machining will be allowed.
- Special setups must be broken down after you have finished the machining.
- Report all accidents to the Shop Manager, TA, or shop monitor.
- Return all tools to their proper place when you have finished using them.
- If you believe that a machine is not functioning properly, inform the Shop Manager, TA, or monitor, so the problem can be addressed.
- If you believe that a piece of material may be hot. Use the back of your hand to check on the heat coming off of the part, without touching it.
- Always clean the machine you have been using, at the end of your session.
- Never work by yourself in the Machine Shop.
- No food or drink is allowed in the Machine Shop.
- Emergency phone number is 314-935-5555.
- Before you begin machining, plan out the machining steps before you begin.
- Do not rush or take chances. Obey all safety rules.
- Do not operate machinery, if you are taking prescription or over the counter medicines that cause dizziness.
- Do not drink any alcoholic beverages before coming to work in the Student Shop.
- Alcoholic is prohibited.

## **5. Guidelines for Shop Clean-Up**

- Clean up the machine or area you were using, before you leave the shop.
- Remove all tooling that you used from the machine, before you start to clean the machine
- Return all tooling to its appropriate place when you are done
- Clean the chips from tools and chip pan. Start at the top of the machine working down to the lowest part of the machine.
- Sweep chips on the floor up using a broom and dust pan
- Do not use compressed air to clean off machinery
- Report any damage, broken tooling, or missing items to the Shop Manager, TA, or monitor
- Plan 15 minutes into your schedule for general cleaning around the machine area you are using
- The Shop Manager, TA, and Monitor have full over the shop. If you are asked to cleanup, or to do a better job at cleaning, please do so.



# STUDENT SHOP Protocols

1. ***Never work alone*** – *In the absence of professional staff, a trained student monitor must be physically present in the shop for any work to occur*
2. ***Loose fitting clothing*** may not be worn in the shop, including ties, scarves, dresses, and loose fitting sweat shirts or hoodies with tassels, long sleeves are prohibited.
3. ***Open-toed shoes*** (flip flops) ***Crocks, Clogs, and house shoes*** are prohibited.
4. ***Short pants, skirts, and dresses*** are prohibited.
5. ***Jackets*** are prohibited when operating equipment.
6. ***Synthetic fabrics:*** It is highly recommended that the listed synthetic fabrics not be worn in the machine shop. These fabrics are vulnerable to hot chips, they have the potential of melting or catching the fabric on fire.
  - a. ***Spandex, Poly/spandex, Lycra (Elastane)***
  - b. ***Nylon • Acetate fabric • Polyester • Rayon • Polypropylene***  
***Clothing items*** that use these materials are generally ***Leggings, jeggins, yoga pants, stirrup pants, nylon pants, and athleisure wear.***
7. A person's ***torso*** and ***upper arms*** are required to be completely covered.
8. ***Remove jewelry*** before beginning work, including rings, necklaces, bracelets, and watches.
9. ***Long hair*** must be pulled back, secured and contained in a bun.
10. ***Long beards*** must also be contained.
11. ***Aisles, exits, and access to emergency equipment*** must be kept clear at all times.
12. ***Cell phones***, mp3 players, ear buds, and other personal electronic devices must not be used when working in the machine shop. Music is prohibited.
13. ***Food is prohibited in the shop, drinks*** are permitted in a designated area only.
14. ***Approval*** to operate power equipment must be obtained thru online an in-person testing prior to use. Once approval to use equipment is obtained you will activate the equipment using Fabman.
15. ***All guards and shields*** must be secured and in place prior to operating equipment.
16. ***Compressed air*** must not be used to clean skin or clothing, or to clean off large amounts of chips off of equipment.
17. ***Do not use damaged equipment***, or equipment that does not appear to be operating normally. Tag it as out of service and report the issue immediately to the Supervisor.
18. ***Immediately report all injuries***, problems or concerns to the Supervisor, Police or Monitor.
19. ***Supervisors and Monitors*** have full authority over the shop and its safe use, including the responsibility, authority, and obligation to prohibit shop or tool access for the safety of an individual, others in the shop, or the equipment.

If Procedures B, C, D, E, G, are not adhered to you may be asked to leave the shop and change your attire.

**EMERGENCY CONTACT: Campus Police 314-935-5555**

**Student Shop Hours 8:30 a.m. – 4:30 p.m. Monday through Friday**

**Extended Shop Hours: Club Team access with an approved reservation and Shop Monitor**

**Monday through Friday 4:30 p.m. - 10:00 p.m.**

**Saturday and Sunday 10:00 a.m. - 8:00 p.m.**

# WASHINGTON UNIVERSITY McKelvey

## MACHINE SHOP FACILITIES

### SAFETY REGULATIONS

1. Use of the machine shop is restricted to persons with specific authorization. Shop use by authorized persons is limited to the hours and conditions established in this document.
2. Users are permitted to employ only those classes of equipment upon which they have been certified and specifically authorized by the shop manager.
3. All injuries and all potentially hazardous situations shall be reported immediately to the shop manager. If no manager is on duty, notify campus police at 314-935-5555.
4. The following general safety regulations shall apply and may be supplemented by more specific regulations for specific areas or machines.
  - a) Eye protection: Protective eye and face equipment shall be worn at all times in the shop. Such equipment shall be in conformity with [ANSI standard Z87.1](#). Eye-glasses with ordinary hardened glass lenses do NOT meet this standard. Where necessary, goggles will be provided by this shop.
  - b) Head Protection: Protective helmets shall be worn when there is a possible danger of head injuries from impact or flying or falling objects. Such helmets may be obtained from the shop and shall meet [ANSI standard Z89.1](#).
  - c) Foot Protection: (e.g., steel toed safety shoes) shall be worn only when there is reasonable probability of injury that can be prevented by such equipment. Safety-toe footwear if needed shall meet the requirements of [ANSI standard Z41.1](#).
  - d) Hair: Long hair must be confined by a net or cap, or pulled back and contained in a bun.
  - e) Clothing: Loose fitting clothing may not be worn in the shop, including ties, scarves, dresses, and loose fitting sweat shirts or hoodies with tassels, long sleeves are prohibited.
  - f) Tools: Only tools in proper working order (e.g., well sharpened) shall be used. If in doubt, consult the shop manager or staff.
5. Failure to conform to appropriate safety procedures in general and to these regulations in particular shall result in instant suspension of shop authorization.

# Washington University Extended Hour Access

## **McKelvey Student Machine Shop**

Any student accessing the machine shop outside of the normal working hours must adhere to the following rules and regulations. After hours is defined as after 4:30 p.m. Monday through Friday, and Saturday or Sunday.

- Only Authorized Shop Users may utilize the Equipment After-Hours. (Authorized Shop Users are those persons who have taken and passed the online and in-person testing for the equipment they intend to use.
- Machine Shop users must not lend their WUSTL ID cards to others for shop access. If you are caught lending out your ID for this purpose you will lose all shop privileges.

**The shop hours are 8:30 AM to 4:30 PM Monday- Friday.**

**Extended Shop Hours: Club Team access with an approved reservation and Shop Monitor**

**Monday through Friday 4:30 p.m. - 10:00 p.m.**

**Saturday and Sunday 10:00 a.m. - 8:00 p.m.**

*In the absence of professional staff, there must be an approved shop monitor physically present in the shop for any work to occur.*

*When you arrive, you legible sign your name, date and time you arrived at the notebook just inside the shop door on the podium.*

*You must sign out of the shop upon completion of your work.*

All Safety Rules must be adhered to and if you see safety rules being ignored please report it to the Shop Manager, staff or monitor immediately, or if the previously mentioned are unavailable, report this to Campus Police ASAP.

- If you are uncertain how to approach a job, do not begin working until you speak with the Shop Manager or staff and understand the correct processes to use. Notify the Shop Manager or staff ASAP if the equipment is in need of repair.
- When finished working in the shop you must clean your machine and the surrounding area, return the tools to their proper place, and sign out of the shop. Make certain the door to the shop is closed and locked behind you when you leave.

# SAFETY OPERATING PROCEDURES

## Milling Machine



Safety glasses must be worn at all times in work areas.



Sturdy footwear must be worn at all times in work areas.



Rings and jewelry must not be worn.



Long and loose hair must be contained.



Close fitting/protective clothing must be worn.



Gloves must not be worn when using this machine.

### POTENTIAL HAZARDS

- Entanglement in rotating parts
- Cuts from sharp cutting tools
- Cuts from metal chips and sharp edges on finished work pieces
- Eye injury from flying debris
- Burns from hot tools or work pieces
- Metal splinters
- Falls due to poor housekeeping around the machine

### PRE-OPERATIONAL SAFETY CHECKS

1. Ensure no slip/trip hazards are present in workspaces and walkways
2. Locate and ensure you are familiar with the operation of the ON/OFF controls
3. Ensure cutter is in good condition and securely mounted
4. Verify the rotation speed for the material being cut and the cutter diameter
5. Bring the machine to a full stop before clearing chips or making adjustments.
6. After shutting off the motor you can use the “Brake” to stop the machine quickly
7. Faulty equipment must not be used. Immediately report suspect machinery

### OPERATIONAL SAFETY CHECKS

1. Keep clear of moving machine parts.
2. Never leave the machine running unattended.
3. Follow correct clamping procedures - keep overhangs as small as possible and check that the work piece is secure.
4. Set the correct RPM speed to suit the cutter diameter, the depth of cut and the material type.
5. Before making adjustments and measurements or before cleaning chip accumulations switch off and bring the machine to a complete standstill.

### HOUSEKEEPING

1. When finished, remove all cutters and tools and store them properly
2. Leave the machine and work area in a safe, clean state.

# SAFETY OPERATING PROCEDURES

## Engine Lathe



Safety glasses must be worn at all times in work areas.



Long and loose hair must be contained.



Sturdy footwear must be worn at all times in work areas.



Close fitting/protective clothing must be worn.



Rings and jewelry must not be worn.



Gloves must not be worn when using this machine.

### POTENTIAL HAZARDS

- Flying objects (such as key left in chuck or objects falling on rotating parts).
- Cuts from contact with cutting tools or pointed end of the live center.
- Cuts from sharp edges on long chips or from sharp edges on the work piece.
- Entanglement in rotating machine parts.
- Pinch points from moving machine parts
- Burns from hot tools or hot work pieces
- Metal splinters
- Falls due to poor housekeeping around the machine

### PRE-OPERATIONAL SAFETY CHECKS

1. Check workspaces and walkways to ensure no slip/trip hazards are present.
2. Verify that you are familiar with the operation of the ON/OFF and E-Stop controls
3. Do not store tools and parts on top of the machine.
4. Remove the chuck key before starting the lathe.
5. Remove all tools from the bed and slides of the machine.
6. Check that the work piece is clamped tightly in the chuck
7. Set the correct rotational speed for machining process.
8. Set the correct feed directions and feed rates for the process.
9. Faulty equipment must not be used. Immediately report suspect machinery.

### OPERATIONAL SAFETY CHECKS

1. Never leave the lathe running unattended.
2. Never try to clear chips away while the machine is running.
3. Never use your bare hand to remove chips.
4. Bring the machine to a complete stop before making adjustments or measurements
5. Do not attempt to slow/stop the chuck or revolving work by hand.
6. Avoid letting chips build up on the tool or job. Stop the machine and remove them.

### HOUSEKEEPING

1. Switch off the machine and reset all guards to a fully closed position.
2. Disengage any active auto-feed controls.
3. Reset the compound slide angle to zero degrees.
4. Clean all chips and/or oil from the machine.
5. Leave the machine in a safe, clean and tidy state.

# SAFETY OPERATING PROCEDURES

## Drill Press



Safety glasses must be worn at all times in work areas.



Long and loose hair must be contained.



Sturdy footwear must be worn at all times in work areas.



Close fitting/protective clothing must be worn.



Rings and jewellery must not be worn.



Gloves must not be worn when using this machine.

### POTENTIAL HAZARDS

- Hair or clothing entanglement in rotating spindle or drill
- Eye injury from flying chips or broken drill
- Cuts from sharp edges & burrs on chips and the work piece.
- Cuts from work piece coming unclamped and spinning with the drill
- Burns from hot drill bit or work piece.
- Splinters from small chips.

### PRE-OPERATIONAL SAFETY CHECKS

1. UNLOCK the TABLE before adjusting its height, relock after adjusting
2. Locate and ensure you are familiar with the operation of the ON/OFF control switch
3. Remove the chuck key from the drill chuck
4. Follow correct clamping procedures to ensure work is secure
5. Ensure that the drill will not drill into the machine table or clamping devices
6. Unplug the power cord from the wall before adjusting the belt drives
7. Adjust spindle speed to suit the material and the drill diameter
8. Faulty equipment must not be used. Immediately report suspect equipment

### OPERATIONAL SAFETY CHECKS

1. Never leave the Drill Press while it is running.
2. Before making adjustments or before cleaning chip accumulations switch off and bring the machine to a complete standstill.
3. Feed downwards at a sufficient rate to keep the drill cutting.
4. Never clear chips while the machine is running – Stop the motor
5. Clear away chips with a brush or other appropriate tool – Not your fingers.
6. Feed with care as the drill breaks through the underside of the work.

### HOUSEKEEPING

1. Switch off the machine and return drills and tools to their proper storage location.
2. Leave the machine in a safe, clean state.

## SAFETY OPERATING PROCEDURES

# Horizontal/Vertical Bandsaw



Safety glasses must be worn at all times in work areas.



Long and loose hair must be contained.



Sturdy footwear must be worn at all times in work areas.



Close fitting/protective clothing must be worn.



Rings and jewellery must not be worn.



Hearing protection may be required for some operations.

## POTENTIAL HAZARDS

- Cuts from contact with saw blade
- Cuts from sharp edges on work piece after cutting
- Burns from hot work piece after cutting

## PRE-OPERATIONAL SAFETY CHECKS

1. Ensure no slip/trip hazards are present in workspaces and walkways.
2. Ensure you are familiar with the location and operation of the ON/OFF switches
3. Use a properly sized push stick to feed the work into the blade
4. Lower the blade guide and guard so that it clears the part by ¼ inch.
5. When cutting wood or plastics start the dust extraction unit before using the saw
6. Faulty equipment must not be used. Immediately report suspect machinery.

## FORBIDDEN (Check with instructor for help)

- Cutting Carbon Composite materials
- Attempting to cut very small items
- Cutting cylindrical or irregular stock

## OPERATIONAL SAFETY CHECKS

1. Never leave the machine running unattended
2. Change the blade speed only while the machine is running
3. Select a proper speed for the blade and material
4. The work piece should be fed forward evenly and held firmly on the table to ensure effective control during cutting whilst keeping hands in a safe position.
5. Use a push stick when feeding material past the blade.
6. Stop the machine before attempting to back the work away from the blade
7. Do not force a wide blade on a cut of small radius
8. Stop the saw immediately if the blade develops a 'click'. Report it to your teacher.

## HOUSEKEEPING

1. Switch off the saw and lower the blade guide to one or two inches above the table
2. Turn off the dust extraction unit if it was in use
3. Leave the machine in a safe, clean and tidy state.

# SAFETY OPERATING PROCEDURES

## Buffing Wheel



Safety glasses must be worn at all times in work areas.



Long and loose hair must be contained.



Sturdy footwear must be worn at all times in work areas.



Close fitting/protective clothing must be worn.



Rings and jewelry must not be worn.



Gloves must not be worn when using this machine.

### POTENTIAL HAZARDS

- Work can be snatched from your hand if improperly presented to buffing wheel
- Hair/ clothing entanglement in moving machine parts
- Eye injuries from ejected particles or thrown work pieces

### FORBIDDEN

- Holding work with gloves, apron, towels or clothing
- Working on the side of the wheel

### PRE-OPERATIONAL SAFETY CHECKS

1. Check workspaces and walkways to ensure no slip/trip hazards are present.
2. Locate and ensure you are familiar with the operation of the ON/OFF switch
3. Use appropriate wax type and polishing compound for the task.
4. Faulty equipment must not be used. Immediately report suspect equipment.

### OPERATIONAL SAFETY CHECKS

1. Never leave the machine running unattended
2. Use the front of the wheel only
3. Work only below the center of the spindle
4. Work should be held so that edges cannot catch on the wheel
5. Small work must be securely supported with a wooden backing
6. Do not bend down near machine while it is running

### HOUSEKEEPING

1. Switch off the machine.
2. Leave the machine in a safe, clean state.



## SAFETY OPERATING PROCEDURES

# Belt/Disk Sander



Safety glasses must be worn at all times in work areas.



Long and loose hair must be contained.



Sturdy footwear must be worn at all times in work areas.



Close fitting/protective clothing must be worn.



Rings and jewelry must not be worn.



Gloves must not be worn when using this machine.

## POTENTIAL HAZARDS

- Work can be snatched from your hand if improperly presented to buffing wheel
- Hair/ clothing entanglement in moving machine parts
- Eye injuries from ejected particles or thrown work pieces
- Fingers being caught between disk and table if the gap is too large
- Fingers can easily be worn to the bone on belt/disk
- Dust particles getting into your eyes
- Timber being thrown up if you hold it against the disk that is rotating up and away from the table

## FORBIDDEN

- More than one operator at a time
- Holding work with gloves, apron, towels or clothing
- Holding work at an angle in the vertical direction, while part of the work rest on the table, and in contact with the sanding belt.

## OPERATIONAL SAFETY CHECKS

1. Never leave the machine while it is running
2. Machine must be at a dead stop before making adjustments
3. Allow machine to reach full speed before use.
4. Fingers should be kept away from the belt/disk at all times
5. Avoid applying pressure the speed will do the sanding for you
6. When using the disk, the work should only be held against the part of the disk that is rotating downwards towards the table.
7. Keep work moving across the sanding area to minimize burning.
8. One person at a time on this machine.
9. When using the disk, the work is to be held firmly on the table with both hands where possible

## HOUSEKEEPING

1. Sweep the machine down and remove all sawdust
2. Leave the machine, as you would like to find it

## SAFETY OPERATING PROCEDURES

# Spot Welder



Safety glasses must be worn at all times in work areas.



Long and loose hair must be contained.



Sturdy footwear must be worn at all times in work areas.



Close fitting/protective clothing must be worn.



Rings and jewellery must not be worn.



Leather gloves should be used to prevent burns.

## POTENTIAL HAZARDS

- Fingers being caught between electrodes
- Fingers and hands can easily be burnt
- Sparks can burn eyes

## FORBIDDEN

- More than one operator at a time
- Use of nylon materials to hold work. Nylon clothing (including socks) should be covered.
- Use of compressed air to clean machine or person.

## OPERATIONAL SAFETY CHECKS

1. Do not use beyond recommended work cycle. Excessive heat will up the arms and electrode.
2. Ensure electrodes have cooled before making any adjustments.
3. Isolate machine before making adjustments or undertaking maintenance.

## HOUSEKEEPING

1. Clean the machine down and remove all waste
2. 2) Leave the machine, as you would like to find it

# SAFETY OPERATING PROCEDURES

## Mig Welder



Safety glasses must be worn at all times in work areas.



Long and loose hair must be contained.



Sturdy footwear must be worn at all times in work areas.



Close fitting/protective clothing must be worn, and leather gloves



Rings and jewellery must not be worn.



Welding helmet must be worn to protect eyes.

### POTENTIAL HAZARDS

- Electric shock
- Fume
- Radiation burns to eyes or body
- Body burns due to hot or molten materials
- Flying sparks

### FORBIDDEN

- More than one operator at a time
- Welding without adequate screens protecting others

### OPERATIONAL SAFETY CHECKS

1. Ensure no slip trip hazards are present in workspaces and walkways.
2. Ensure the work area is clean and clear of grease, oil, and any flammable materials.
3. Keep the welding equipment, work area and gloves dry to avoid electric shocks.
4. Ensure the gloves, welding gun and work leads are in good condition.
5. Ensure other people are protected from flashes by closing curtain to welding bay or erecting screens.
6. Ensure fume extraction unit is on before beginning welding operation.
7. Ensure the work leads do not create a tripping hazard.
8. Faulty equipment must not be used. Immediately report suspect equipment.
9. Ensure machine is correctly set up for current, voltage, wire feed and gas flow.
10. Ensure work return cables make firm contact to provide a good electrical connection.
11. Never leave the welder running unattended.
12. Take care to avoid flashes.

### HOUSEKEEPING

1. Switch off the machine and fume extraction.
2. Close gas cylinder valve.
3. Hang up welding gun and welding cables.
4. Leave the work area in a safe, clean and tidy state.

# SAFETY OPERATING PROCEDURES

## Tig Welder



Safety glasses must be worn at all times in work areas.



Long and loose hair must be contained.



Sturdy footwear must be worn at all times in work areas.



Close fitting/protective clothing must be worn, and leather gloves



Rings and jewellery must not be worn.



Welding helmet must be worn to protect eyes.

### POTENTIAL HAZARDS

- Electric shock
- Fume
- Radiation burns to eyes or body
- Body burns due to hot or molten materials
- Flying sparks

### FORBIDDEN

- More than one operator at a time
- Welding without adequate screens protecting others

### OPERATIONAL SAFETY CHECKS

1. Ensure no slip trip hazards are present in workspaces and walkways.
2. Ensure the work area is clean and clear of grease, oil, and any flammable materials.
3. Keep the welding equipment, work area and gloves dry to avoid electric shocks.
4. Ensure the gloves, welding gun and work leads are in good condition.
5. Ensure other people are protected from flashes by closing curtain to welding bay or erecting screens.
6. Ensure fume extraction unit is on before beginning welding operation.
7. Ensure the work leads do not create a tripping hazard.
8. Faulty equipment must not be used. Immediately report suspect equipment.
9. Ensure machine is correctly set up for current, voltage, wire feed and gas flow.
10. Ensure work return cables make firm contact to provide a good electrical connection.
11. Never leave the welder running unattended.
12. Take care to avoid flashes.

### HOUSEKEEPING

1. Switch off the machine and fume extraction.
2. Close gas cylinder valve.
3. Hang up welding gun and welding cables.
4. Leave the work area in a safe, clean and tidy state.

## SAFETY OPERATING PROCEDURES

# Table/Pedestal Grinder



Safety glasses or full face shield must be worn at all times.



Long and loose hair must be contained.



Sturdy footwear must be worn at all times in work areas.



Close fitting/protective clothing must be worn.



Rings and jewelry must not be worn.



Gloves must not be worn when using this machine.

## POTENTIAL HAZARDS

- Fingers can be caught and trapped between wheel and work or tool rest
- Loose clothing, long hair, watches, rings and dangling bracelets and necklaces
- Working above center or sides of the grinding wheel
- Face and eye injury

## FORBIDDEN

- More than one operator at a time
- Use of gloves or cloth to hold work
- Use of safety glasses only
- Use of the side of a “normal” wheel

## OPERATIONAL SAFETY CHECKS

1. One person only to use machine at a time.
2. Check that all safety guards are in position
3. Never leave the machine while it is running
4. Wait for the machine to stop before picking up dropped project from the floor
5. Do not stand behind the machine
6. Do not converse with the operator whilst the machine is going
7. Do not wear gloves or use cloth, pliers etc to hold work piece
8. Work only in the designated safe area of the wheel

## HOUSEKEEPING

1. Leave the machine, as you would like to find it

## SAFETY OPERATING PROCEDURES

# Oxygen Acetylene Welding



Safety glasses must be worn at all times in work areas.



Sturdy footwear must be worn at all times in work areas.



Rings and jewelery must not be worn.



Long and loose hair must be contained.



Close fitting/protective clothing must be worn, and leather gloves



Welding helmet or goggles must be worn to protect eyes.

## POTENTIAL HAZARDS

- Burns to all parts of the body including eyes

## FORBIDDEN

- 1) More than one operator at a time.
- 2) Lighting blowtorch with matches or lighter.
- 3) Gas and Electric welding in same area at same time.
- 4) Using oxygen as a substitute for compressed air.

## OPERATIONAL SAFETY CHECKS

### PRESSURE SETTING

- 1) Check that the oxygen and acetylene regulator adjusting knobs are loose.
- 2) Check that both blowpipe valves are closed.
- 3) Slowly open the cylinder valves on each cylinder for half a turn only.
- 4) Screw in the regulator adjusting knobs slowly until the delivery pressure gauges register 10 PSI.
- 5) Purge and check for constant oxygen gas flow.

Open the oxygen blowpipe for 2 seconds valve and check the delivery gauge.

If necessary re-adjust the oxygen regulator to achieve a 10 PSI pressure.

Close the oxygen blowpipe valve.

- 6) Purge and check for constant acetylene gas flow.

Open the acetylene blowpipe valve for 2 seconds and check the delivery gauge.

If necessary re-adjust the acetylene regulator to achieve a 10 PSI pressure.

Close the acetylene blowpipe valve.

### LIGHTING UP

- 1) Open the acetylene blowpipe valve slightly and light the blowpipe with a flint lighter.
- 2) Continue to slowly open the acetylene valve until the flame no longer produces soot.
- 3) Slowly open the oxygen blowpipe valve until a neutral flame is produced.

### SHUTTING OFF BLOWPIPE

- 1) Close the acetylene blowpipe valve first.
- 2) Then close the oxygen blowpipe valve.

### CLOSING DOWN

- 1) Close down both cylinder valves.
- 2) Open oxygen blowpipe valve to allow the gas to drain out.
- 3) When oxygen gauges read zero, unscrew regulator-adjusting knob.
- 4) Close oxygen blowpipe valve.
- 5) Turn off acetylene cylinder valve.
- 6) Open acetylene blowpipe valve and release gas.
- 7) When acetylene gauges read zero, release regulator adjusting knob.
- 8) Close acetylene blowpipe valve.

## HOUSEKEEPING

1. Sweep the machine down and remove all waste
2. 2) Hang up blowpipe and hoses
3. 3) Leave the machine, as you would like to find it

## SAFETY OPERATING PROCEDURES

# Metal Cutting Guillotine

**DO NOT use this machine unless a teacher has instructed you in its safe use and operation and has given permission.**



Safety glasses must be worn at all times in work areas.



Long and loose hair must be contained.



Sturdy footwear must be worn at all times in work areas.



Close fitting/protective clothing must be worn.



Rings and jewellery must not be worn.



Gloves must not be worn when using this machine.

**Only one person may operate this machine at any one time.**

### PRE-OPERATIONAL SAFETY CHECKS

1. Ensure fixed guards are in place to prevent hands or other parts of the body from entering the trapping space.
2. Guards or safety devices must never be removed or adjusted, except by an authorized person for maintenance purposes.
3. Working parts should be well lubricated and free of rust and dirt.
4. The area around the machine must be adequately lit and kept free of materials, which might cause slips or trips.
5. Be aware of other personnel in the immediate vicinity and ensure the area is clear before using equipment.
6. Familiarise yourself with and check all machine operations and controls.
7. Ensure cutting table is clear of scrap and tools.
8. Faulty equipment must not be used. Immediately report suspect machinery.

### OPERATIONAL SAFETY CHECKS

6. Do not attempt to cut material beyond the capacity of the machine.
7. Never attempt to cut rod, strap or wire with this machine.
8. Use correct lifting procedures when handling large sheets of material.
9. Take extreme care during the initial feeding of the workpiece into the machine.
10. The workpiece should always be held sufficiently far back from the edge being fed into the guillotine.
11. Ensure fingers and limbs are clear before actuating the guillotine.
12. Hold material firmly to prevent inaccurate cutting due to creep.
13. When cutting ensure feet are positioned to avoid contact with the foot operated lever.

### HOUSEKEEPING

3. Remove all off cuts and place them in either in the storage rack or waste bin.
4. Leave the work area in a safe, clean and tidy state.

### POTENTIAL HAZARDS

- Sharp edges and burrs
- Crush and pinch points
- Manual handling sheets

# SAFETY OPERATING PROCEDURES

## Compound Mitre Saw



Safety glasses must be worn at all times in work areas.



Sturdy footwear must be worn at all times in work areas.



Rings and jewellery must not be worn.



Long and loose hair must be contained.



Close fitting/protective clothing must be worn.



Hearing protection must be worn when using this machine.

### PRE-OPERATIONAL SAFETY CHECKS

1. Ensure the saw is properly secured to a worktable by bolts/ clamps at approximately hip height.
2. Ensure the saw is operated on an GFCI protected circuit.
3. Check workspaces and walkways to ensure no slip/trip-hazards are present.
4. Check that all safety guards are in position and are operational.
5. Ensure you are familiar with the operation of the ON/OFF switch.
6. Keep table and work area clear of all tools, off-cut timber and sawdust.
7. Start the dust extraction unit before using the machine (if equipped).
8. Faulty equipment must not be used. Immediately report suspect equipment.

### OPERATIONAL SAFETY CHECKS

1. The maximum cut for the machine must not be exceeded.
2. Ensure all adjustments are secure before making a cut.
3. Use clamps to secure and support the workpiece to a stable platform. Do not use a length stop on the free scrap end of a clamped workpiece.
4. Do not cut more than one workpiece at a time.
5. Before turning on the saw, perform a dry run of the cutting operation to ensure that no problems will occur when the cut is made.
6. Do not start the saw with the blade touching the workpiece. Allow the blade to reach full speed before contacting the workpiece.
7. Avoid reaching over the saw line. Do not cross arms when cutting.
8. When using the right hand to pull the saw down, keep the left hand, especially the thumb well clear of the line of cut.
9. If workpiece is bowed or warped, clamp it with the outside bowed face toward the fence.
10. After finishing the cut, release the switch, hold the saw arm down and wait for blade to stop before removing work or off-cut piece.
11. Disconnect the plug from the power source and bring the machine to a complete standstill before making any adjustments.

### HOUSEKEEPING

1. Leave the machine in a safe, clean and tidy state.

### POTENTIAL HAZARDS

- Saw may grab and 'kick-back' toward operator
- Flying chips and airborne dust
- Contact with rotating blade
- Eye injuries
- Noise

### FORBIDDEN

- Cutting branches, wood with embedded nails or screws
- Cutting dowel
- Ripping solid timber along the grain
- Cutting ferrous or non-ferrous material



# SAFETY OPERATING PROCEDURES

## Pan Brake

**DO NOT use this machine unless a teacher has instructed you in its safe use and operation and has given permission.**



Safety glasses must be worn at all times in work areas.



Long and loose hair must be contained.



Sturdy footwear must be worn at all times in work areas.



Close fitting/protective clothing must be worn.



Rings and jewellery must not be worn.



Gloves must not be worn when using this machine.

### PRE-OPERATIONAL SAFETY CHECKS

1. Guards or safety devices shall never be removed or adjusted, except by an authorized person for maintenance purposes.
2. Working parts should be well lubricated and the jaws and fingers free of rust and dirt.
3. Ensure no slip/trip hazards are present in workspaces and walkways.
4. Be aware of other personnel in the immediate vicinity and ensure the area is clear before using equipment.
5. Familiarise yourself with and check all machine operations and controls.
6. Faulty equipment must not be used. Immediately report suspect machinery.
- 7.

### OPERATIONAL SAFETY CHECKS

1. Never use pan brakes for bending metal that is beyond the machine's capacity with respect to thickness, shape, or type.
2. Never attempt to bend rod, wire, strap, or spring steel sheets in a pan brake.
3. Remove the pan brake fingers that are in the way - use only the pan brake fingers required to make the bend.
4. Ensure the pan brake fingers that are not removed for an operation are securely seated and firmly tightened before the machine is used.
5. Ensure fingers and limbs are clear before operating the pan brake.
6. Lower finger clamps to work - do not drop.
7. Check workpiece is secure.
8. Keep clear of moving counterweight (where fitted).

### HOUSEKEEPING

1. Lower finger clamps to a safe position.
2. Return all accessories to storage racks.
3. Leave the work area in a safe, clean and tidy state.

### POTENTIAL HAZARDS

- Sharp edges and burrs
- Squash/crush and pinch points

## SAFETY OPERATING PROCEDURES

# Air Compressor

**DO NOT** use this machine unless a teacher has instructed you in its safe use and operation and has given permission.



Safety glasses must be worn at all times in work areas.



Sturdy footwear must be worn at all times in work areas.



Rings and jewellery must not be worn.



Long and loose hair must be contained.



Close fitting/protective clothing must be worn.



Ensure all flammable materials are safely stored.

### PRE-OPERATIONAL SAFETY CHECKS

9. Ensure no slip/trip hazards are present in workspaces and walkways.
10. Locate the compressor in a suitable location for safe operation.
11. Lock the wheels on the base of the compressor to prevent movement (If equipped).
12. Check that all fittings and connections are in good condition prior to starting.
13. Check all fittings are securely connected prior to being pressurised.
14. Faulty equipment must not be used. Immediately report suspect machinery.
15. Locate and ensure you are familiar with the operation of the ON/OFF switch.

### OPERATIONAL SAFETY CHECKS

14. Start the compressor noting pressure increase and cut-out/cut-in pressure.
15. Listen for any air leaks from any flexible airlines and immediately report if any leaks are observed.
16. Adjust pressure regulator to suit work requirements.
17. Check the compressor at regular intervals.

### HOUSEKEEPING

5. Switch off machine.
6. Leave the machine, hose and work area in a safe, clean and tidy state.

### POTENTIAL HAZARDS

- Unsecured hoses whipping under pressure
- Compressed air