

Integrated Research and Machining Centre



SAFETY MANUAL

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1.0 Scope

The scope of this manual is to provide a basic guide to the safe operation of the machinery in the integrated Research and Machining Centre (IRMC) and to provide the basic rules for operating that machinery. This guide cannot replace the advice and instruction given by the shop technicians.

Due to the diverse hazards in the IRMC, it is essential that all safety rules and procedures are followed. The user is ultimately responsible for his or her own safety. If you are ever unsure of anything, ask for clarification.

2.0 Access to IRMC

2.1 Orientation & Training

All students and staff must receive an orientation to the IRMC. This orientation will include the layout of the IRMC, emergency electrical shut off, identification of all the machinery, cutting tools, hand tools, first aid kit, fire extinguishers, emergency egress and muster locations, eyewash stations and showers. Safety protocols, procedures, and equipment are covered. A brief explanation will be given to describe how each machine is used. The focus of the site orientation is on safety and working safely.

Each student and staff will be required to sign the IRMC Policy Acknowledgement form upon completion, Appendix A. Students or staff who have not participated in the orientation or have not submitted a signed acknowledgement form will be prohibited from using the IRMC. The signed form is to be submitted to the Lab Manager for record keeping.

Upon completion of the orientation, a training record card will be provided. This card will be updated as further training is received. This card must be shown to the shop technician prior to commencing work as proof of training completed. Specific machine tool safety-based training will be provided on a one-on-one basis as required.

There is no after hours use of the IRMC. All work must be scheduled within working hours and users will ensure enough time is set aside at the end of day for cleanup.

2.2 WHMIS

All students and staff using the IRMC must have successfully completed Workplace Hazardous Materials Information System (WHMIS) training known as the "Chemical Safety Course". This course is offered through Risk Management Services <http://riskmanagement.ok.ubc.ca/register/whmissafety.html>.

2.3 Guests and Visitors

Guests and Visitors are only permitted in the facility when accompanied by one of the shop technicians, and only if they are wearing the appropriate safety gear. Guests and visitors are never to work in the IRMC until appropriate training has been provided.

A mandatory safety orientation is required before using the facility. Upon completion of the orientation, specific training will be provided on the equipment. There is absolutely no unauthorized use of the IRMC. Upon completion of the initial orientation, a training record card will be provided. This card is to be shown to the shop technicians prior to any work as proof of completion of the appropriate training. Users will also have to sign a policy acknowledgement form prior to using the shop.

2.4 IRMC Occupancy

The primary responsibility of shop technicians is to monitor the safety of shop users. The number of users an individual shop technician can effectively monitor is affected by many factors. It is each shop technician's responsibility to determine how many users can be effectively monitored under any given circumstances.

A maximum occupancy of the IRMC is limited to 30 people in the shop at all times. Only one person is permitted to use a machine tool at a time. The technician on duty has the right to reduce the maximum occupancy limit if circumstances warrant.

Application of this policy is left to the discretion of the technician on duty. Resolution of any disputes regarding the application of this policy is the responsibility of the School of Engineering Lab Manager.

3.0 General Safety

3.1 General Safety Rules

1. Students and staff must co-operate fully with the shop technician and must follow the rules without exception. Students and staff are expected to report any incident or near miss regardless of how minor. Minor cuts or abrasions are treated by calling Campus Security. Shop technicians advise students of health and safety on campus.
2. Do not enter shop while tired or under the influence of drugs, alcohol, and any medications that may cause drowsiness or have the potential to adversely affect your work.
3. Do not use equipment on which you have not been trained. It is the student and staff's responsibility to seek out, receive and understand instruction in the proper use of all tools and equipment available in the shop before he or she attempts to use the tools or equipment.
4. When operating milling machines, lathes, and drill presses, never remove chips with your bare hands. The chips can be razor sharp and should be removed with pliers or a brush, and only after the machine has been turned off and stopped.
5. All students and staff using the IRMC or hand tools must wear appropriate Personal Protective Equipment (PPE). The minimum PPE required in the IRMC is CSA approved footwear, CSA safety glasses, and long pants that offer protection from chemicals and sharp objects. Depending on the work being performed, goggles, hearing protection, gloves and face shield may be required. There is absolutely no access to users who are not wearing the appropriate safety equipment.
6. Long hair must be tied back. Dangling jewelry, rings, watches, bracelets, etc. must not be worn. No loose clothing is allowed in the IRMC.
7. Hearing protection is required when noise levels are excessive (>85 dBA).
8. Dust masks (N95 or better) are encouraged when you are cutting material that makes airborne particles. Users are to be fit tested prior to using the masks.
9. Cell phones, MP3 players, and any devices with headphones are prohibited in the IRMC. **Your complete attention is necessary in order to work safely.**
10. Keep your work area tidy. Clean up after yourself.
11. Floors must be swept and all tools must be put away at the end of each work period.
12. Metal chips and scrap material must be swept up and disposed of.
13. Questions regarding safety issues must be referred to the technician.
14. Spray painting is not allowed in the shop.

15. Never have a conversation with, or otherwise distract someone, operating machinery.
16. Immediately report any defective equipment or absence of a protective device (guarding) to the shop technician on duty.
17. Do not attempt to repair any broken or malfunctioning equipment. Notify the shop technician.
18. Immediately report all incidents and near misses or existence of any hazards to the shop technician on duty.
19. Any machine in need of repair will be locked out. Never attempt to use a machine that has been locked out. Never remove a lockout device that you did not install.
20. Do not use stationary equipment work surfaces for uses other than their intended purpose; for example, for sanding, project assembly, layout, applying finishes, etc.
21. All safety guards must be kept in place while operating equipment.
22. Materials should never be fed into a machine faster than it will cut or sand.
23. Personal power tools are prohibited in the IRMC.
24. Turn off machines when you are finished. Never leave any machine running unattended.
25. Never grind or sand toxic or hazardous material such as composites, concrete or fiberglass.
26. One operator per machine tool. Example: Three people turning the X travel and the Y travels of a milling machine is not permitted.

3.2 Safety Equipment

The first aid kit is located inside of the IRMC on the east wall. There are two eyewash station and showers located on the north wall beside the sink and on the east wall by the Emergency Stop button. NOTE: first aid equipment and materials are strictly for first aid emergencies.

Safety equipment is tested regularly to ensure proper function. Records of inspections are to be kept. Any deficiencies are to be corrected immediately, prior to work commencing.

4.0 Emergency Procedures

4.1 First Aid Emergency Procedures

4.1.1 Major injury/illness:

Call Campus Emergency at **250.807.8111** or local **78111** or **911**.

4.1.2 Minor injury/illness:

Call Campus Emergency at **250.807.8111** or local **78111**

4.1.3 Campus Emergency Information:

Risk Management Services

Okanagan Campus

LIB018 - 3287 University Way

Kelowna, BC Canada V1V 1V7

Tel 250-807-8859

Email riskmanagement.ok@ubc.ca

<http://riskmanagement.ok.ubc.ca/welcome.html>

Campus Security

Okanagan Campus
LIB016 - 3287 University Way
Kelowna, BC Canada V1V 1V7
Tel 250.807.8111 (Emergency Calls)
250.807.9236 (Non-Emergency Calls)
Email security.ubco@ubc.ca
<http://security.ok.ubc.ca/welcome.html>

4.2 Fire Alarm Procedures

4.2.1 Building alarms while working in IRMC

- 4.2.1.1 Stop what you are doing.
- 4.2.1.2 Shut off all machinery, equipment and tools.
- 4.2.1.3 Exit the IRMC and proceed to designated muster station, following instructions of the fire warden.

4.2.2 In case of fire inside IRMC

- 4.2.2.1 Leave fire area and close doors.
- 4.2.2.2 Activate wall-mounted fire alarm pull station located at exits.
- 4.2.2.3 Attempt to extinguish fire only if it is small and contained, you feel comfortable doing so and you have a way out. You are not obligated to fight a fire.
- 4.2.2.4 Report any information about fire to the building fire marshal or fire department.

4.2.3 If you are on fire

- 4.2.3.1 STOP where you are.
- 4.2.3.2 DROP to the floor or ground.
- 4.2.3.3 ROLL your body to smother the fire.

4.2.4 If Unable To Evacuate

- 4.2.4.1 Call Campus security indicating your location and situation.
- 4.2.4.2 A closed door can provide good protection against fire and smoke. Use available materials to seal door and air ducts.
- 4.2.4.3 If smoke enters room, stay low as heat and smoke rise.
- 4.2.4.4 Signal your position at a window.
- 4.2.4.5 Persons with mobility difficulties or who use wheelchairs should move to an area of refuge, such as a stairwell, if unable to evacuate to muster station. Ensure fire warden is aware of your position.

4.2.5 Controlled Evacuation

In non-fire situations threatening safety, such as building services interruption or hazardous material spill, buildings are evacuated under direction of Campus Security and emergency response services. The fire alarm should not be used to evacuate a building.

4.2.6 Fire Code Requirements

1. Open flames, including candles, are not permitted in buildings except as part of lab apparatus, approved food services and maintenance/construction approved by Facilities Operations.
2. Bicycles are not allowed in buildings, except in approved designated locations.
3. Corridors and stairwells must be free of obstructions and any combustible or flammable materials. Items located in a corridor or stairwell must be approved by Risk Management Services.
4. Self-closing doors must be able to close. Wedges are only permitted as a temporary measure while attended, to hold doors open.
5. All doors are to be free of obstruction.
6. Fire safety equipment including exit signs, fire extinguishers, and fire hose cabinets must be kept unobstructed.
7. Electrical panels are to be free of obstruction.
8. Eyewash stations and showers are to be free of obstruction.
9. Willful fires, false fire alarms and tampering with fire equipment are offenses under the law.

Refer to UBC Emergency Procedures and Information

<http://emergency.ok.ubc.ca/procedures/firesafety.html>

5.0 Waste Management

All waste material generated must be handled and stored according to local, provincial and federal legislation. Refer to RMS website for proper waste management instructions.

<http://riskmanagement.ok.ubc.ca/environment/hazardousmaterials.html>

5.1 Chemical Spills

For spills 1 L or more, or for spills you are not easily able to control and clean up, call Campus Security for assistance, 250 807 8111. For small spills (less than 1 L) clean up after consulting the MSDS and donning appropriate PPE. Ensure waste is properly labeled and sent for disposal according to UBC's waste management system.

6.0 Injury / Incident Reporting

Under no circumstances will anyone be punished for reporting incidents. The reporting of incidents is not to assign blame, but to ensure the incident or similar incidents do not occur in the future. It is also appropriate to report potential problems or "good catches" prior to anything happening so corrective actions can be implemented. Failure to report incidents will result in disciplinary action.

In the event of an injury in the IRMC, inform the shop technician immediately. The technician will call for appropriate first aid treatment if necessary.

Contact Campus Security by phoning 250-807-8111, local 8111, or by dialing 911.

Note: The IRMC is located on the lower floor of the building and cell phone service is limited. Use the landline phone located on the north wall of the office.

In the event of incident resulting in machine damage, building damage or near misses, the shop technician should be informed immediately. The circumstances will be reviewed and recommendations made to correct the hazardous situation.

Failure to follow these rules will result in the following disciplinary action:

1. Verbal warning – will be recorded and kept on file. Corrective action will be required.
2. Formal written warning
3. Loss of IRMC privileges

Severity may involve bypassing warnings and going straight to disciplinary action.

All incidents will be followed up with a report to Risk Management Services. This is completed through the online CAIRS system, https://www.cairs.ubc.ca/public_page.php

Only after completion of the incident reporting will shop access resume. It is imperative that corrective measures are put in place.

7.0 Machine Tools

7.1 Milling Machine

Milling is the machining process of using rotary cutters to remove material from a work-piece. This is accomplished by advancing (or feeding) a work-piece at an angle with the axis of the tool. The milling machine is one of the most common metal removal devices in industry and machine shops today. It is used for machining parts to precise sizes and shapes.

These machines are available for manual operation (shown) or may be computer numerically controlled (CNC).



DO NOT use this machine unless the technician has instructed you in its safe use and operation.

PPE REQUIRED

- Safety glasses must be worn at all times in work areas.
- Long and loose hair must be contained.
- CSA approved footwear.
- Close fitting/protective clothing must be worn.
- Never wear rings or jewelry while operating the milling machine.
- Never wear gloves when using this machine.
- Hearing protection should be used when noise levels exceed 85 dBA.
- Dust mask must be used when you are cutting material that makes airborne particles.

PRE-OPERATIONAL SAFETY CHECKS

1. Ensure no slip/trip hazards are present in workspaces and walkways.
2. Be certain the cutting tool and tool-holder are tightly secured.
3. You **MUST** remove the wrench from the drawbar on top of the machine after tightening the tool-holder before turning the machine on.

4. Check that the chuck key has been removed if using a drill chuck.
5. Follow correct part clamping procedures - keep overhangs as small as possible and check that the work-piece is secure to the machine table.
6. Locate and ensure you are familiar with the operation of the ON/OFF starter switch and Emergency Stop button (if equipped).
7. Do not leave tools on top of the machine.
8. Check that all machine guards are in position.
9. Check the coolant delivery system to ensure sufficient flow of coolant when required.
10. Faulty equipment must not be used. Immediately report suspect machinery.

OPERATIONAL SAFETY CHECKS

1. Keep clear of moving machine parts.
2. Turn off main power or engage emergency stop button before attempting to do a tool change.
3. Set the correct speed to suit the cutter diameter, the depth of cut and the material.
4. Be aware of the direction of flying chips and always use an appropriate guard.
5. Never leave the machine running unattended.
6. Before making adjustments and measurements or before cleaning cuttings, switch off the power and bring the machine to a complete standstill.
7. No filing or polishing work piece with spindle running.
8. Do not use a drill bigger than 0.5" (12.7mm) diameter in metal without technician's supervision.

HOUSEKEEPING

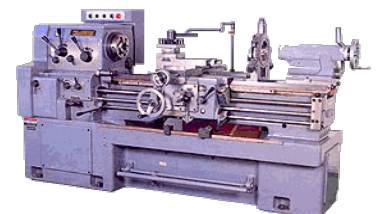
1. Switch off the machine.
2. Put back all tooling used safely.
3. Leave the machine and work area in a safe, clean and tidy state.

POTENTIAL HAZARDS

- Sharp cutters
- Moving components - hair/clothing entanglement
- Eye injury
- Skin irritation
- Respiratory irritation
- Metal splinters and burrs
- Flying debris

7.2 Lathe

A lathe is a machine tool that rotates the work-piece on its axis to perform various operations such as cutting, sanding, knurling, drilling, facing, turning. Tools are applied to the work-piece to create an object that has symmetry



about the axis of rotation. These machines are available for manual operation (shown) or may be computer numerically controlled (CNC).

DO NOT use this machine unless the technician has instructed you in its safe use and operation.

PPE REQUIRED

- Safety glasses must be worn at all times in work areas.
- CSA approved footwear.
- Long and loose hair must be contained.
- Close fitting/protective clothing must be worn.
- Never wear rings or jewelry while operating the lathe.
- Never wear gloves when using this machine.
- Hearing protection should be used when noise levels exceed 85 dBA.
- Dust mask must be used when you are cutting material that makes airborne particles.

PRE-OPERATIONAL SAFETY CHECKS

1. Check workspaces and walkways to ensure no slip/trip hazards are present.
2. Check that the work-piece is clamped tightly in the chuck.
3. You **MUST REMOVE** the chuck key before starting the lathe.
4. Be certain that the cutting tool and tool-holder are tightly secured.
5. Check for clearance between the chuck and tool-holder before starting (rotate the chuck by hand to ensure adequate clearance).
6. Locate and ensure you are familiar with the operation of the ON/OFF switch and foot operated Emergency Stop (if equipped).
7. Ensure all guards are in place.
8. Do not stand in front of the chuck when the lathe is running.
9. Remove all tools from the bed and ways of the machine.
10. Ensure the correct speed for the machining process is selected.
11. Do not try to lift chucks or face plates that are too heavy for you. Ask for help.
12. Faulty equipment must not be used. Immediately report suspect machinery.

OPERATIONAL SAFETY CHECKS

1. Never leave the lathe running unattended.
2. Turn off main power or engage emergency stop button before attempting to do adjust the work piece or measure the work piece.
3. Before making adjustments or measurements, switch off the lathe and bring the machine to a complete standstill. Use the Emergency Stop button if adjusting the chuck.
4. Do not attempt to slow/stop the chuck or turn the work-piece by hand.
5. Avoid letting cuttings build up on the tool or job. Stop the machine and remove it.
6. Always remove the chuck key from the chuck. Never leave the machine with the chuck key inserted.
7. Do not store tools and parts on top of the machine. Chuck key and tool post are the only tools permitted to be stored on top of the machine.
8. No filing or polishing work piece with spindle running.

9. Do not use a drill bigger than 0.5" (12.7mm) diameter in metal without technician's supervision.

HOUSEKEEPING

1. Put back all tooling used safely.
2. Leave the machine in a safe, clean and tidy state.

POTENTIAL HAZARDS

- Flying objects - chuck key left in chuck
- Cutting tool injury when cleaning, filing or polishing
- Rotating machine parts – hair/clothing entanglement
- Metal splinters/cuttings
- Eye injuries
- Respiratory irritation

7.3 Drill Press

The drill press is capable of drilling holes up to 1.5" (38.1mm) in diameter in metal. It is mandatory you firmly clamp your work-piece to the drill press table, with steel parallels in between. If possible, position the hole in the table under the drill bit.



DO NOT use this machine unless the technician has instructed you in its safe use and operation.

PPE REQUIRED

- Safety glasses must be worn at all times in work areas.
- CSA approved footwear.
- Long and loose hair must be contained.
- Close fitting/protective clothing must be worn.
- Never wear rings or jewelry while operating the drill press.
- Never wear gloves when using this machine.
- Hearing protection should be used when noise levels exceed 85 dBA.

PRE-OPERATIONAL SAFETY CHECKS

1. Check workspaces and walkways to ensure no slip/trip hazards are present.
2. Always be aware of where your fingers are in relation to the drill bit.
3. Do not use bits that are dull, bent or damaged.
4. Locate and ensure you are familiar with the operation of the ON/OFF switch and Emergency Stop.
5. Make sure the bit is centered in the chuck and tightened with the chuck key before starting the drill.
6. Before you begin, check with the technician to ensure the rpm is correct for your job.
7. Do not turn the drill press on before clearing the table of all objects (tools, scrap pieces, etc.)

OPERATIONAL SAFETY CHECKS

1. You **MUST** remove the chuck key before turning the machine on.
2. Do not use a drill bigger than 0.5" (12.7mm) diameter in metal without technician's supervision.
3. Use a clamp or vise when drilling; this will help prevent the material from spinning into your body or hand.
4. Do not hold the work-piece in your hand while drilling.
5. When operating the drill press, do not wear gloves, or loose clothing.
6. Avoid awkward hand positions where a sudden slip could cause a hand to move into the drill bit or cutting tool.
7. When using a hole saw, clamp work securely to the table to prevent rotation of the work-piece.

Tip: Use a center punch followed by a center drill to mark/start your holes. This will help the tip of the drill bit align with the center more accurately.

HOUSEKEEPING

1. Switch off the machine and remove drill from chuck.
2. Put back all tooling used safely.
3. Leave the machine in a safe, clean and tidy state.

POTENTIAL HAZARDS

- Flying objects - chuck key left in chuck
- Rotating machine parts – hair/clothing entanglement
- Metal splinters/cuttings
- Eye injuries

7.4 Horizontal Band Saw

This machine is used to cut material to the desired length for later use in lathes, milling machine, etc.

DO NOT use this machine unless the technician has instructed you in its safe use and operation.

PPE REQUIRED

- Safety glasses must be worn at all times in work areas.
- CSA approved footwear.
- Long and loose hair must be contained.
- Close fitting/protective clothing must be worn.
- Never wear rings or jewelry while operating the cut-off saw.
- Hearing protection should be used when noise levels exceed 85 dBA.



PRE-OPERATIONAL SAFETY CHECKS

1. Ensure no slip/trip hazards are present in workspaces and walkways.
2. Check that all guards are in position.
3. Ensure the hydraulic damping mechanism functions properly.
4. Check that the blade is in good condition.
5. Ensure that blade speed, blade tension and blade tracking are properly adjusted.
6. Check the coolant delivery system to ensure sufficient flow of coolant.
7. Locate and ensure you are familiar with the operation of the ON/OFF switch and Emergency Stop (if fitted).
8. Faulty equipment must not be used. Immediately report suspect machinery.

OPERATIONAL SAFETY CHECKS

1. Lift the head of unit up and lock it in the upward position.
2. Set the angle of the vise, or check it to ensure its squareness.
3. Clamp work piece firmly into the vise. Long material must be supported.
4. Adjust blade guards to cover the unused portion of the blade.
5. Ensure hands are away from the blade, and then turn the machine on.
6. Allow the upper head assembly to come down slowly until the teeth are cutting the material.
7. Keep hands away from the point of operation during cutting.
8. Turn off the machine and bring it to a complete standstill if the blade is to be lifted out of an incomplete or jammed cut.
9. Stop the machine and bring it to a complete standstill before removing scrap pieces from the vise area or making adjustments.
10. Stop the saw immediately if the blade develops a 'click'. Report it to the technician.
11. Ensure the cutting head is locked in the upward position before removing work-piece from vise.
12. Do not push down on the cutting head while it is cutting.
13. Do not leave the machine running unattended.

HOUSEKEEPING

1. Switch off the saw and reset all guards to a fully closed position.
2. Leave the machine in a safe, clean and tidy state.

POTENTIAL HAZARDS

- Sharp cutters
- Moving components - hair/clothing entanglement
- Eye injury
- Skin irritation
- Respiratory irritation
- Metal splinters and burrs
- Hearing loss

7.5 Bench Grinder

A bench grinder is a type of bench top grinding machine used to drive abrasive wheels. A pedestal grinder is a larger version of a bench grinder that is mounted on a pedestal. These types of grinders are commonly used to hand grind cutting tools and perform other rough grinding.



DO NOT use this machine unless the technician has instructed you in its safe use and operation. Only one person may operate this machine at any one time.

PPE REQUIRED

- Safety glasses must be worn at all times in work areas.
- Long and loose hair must be contained.
- CSA approved footwear.
- Close fitting/protective clothing must be worn.
- Never wear rings or jewelry while operating the grinder.
- Hearing protection should be used when noise levels exceed 85 dBA.
- Gloves should not be worn except when authorized by the technician.

PRE-OPERATIONAL SAFETY CHECKS

1. Check workspaces and walkways to ensure no slip/trip hazards are present.
2. Ensure all guards and safety shields are in position before starting the grinder.
3. Ensure that the wheels do not touch the work rest and that the gap between wheel and rest is no greater than 1/16" (1.5mm.)
4. Check that wheels are running true and are not glazed or loaded.
5. Locate and ensure you are familiar with the operation of the ON/OFF switch.
6. Faulty equipment must not be used. Immediately report any suspect machinery.

OPERATIONAL SAFETY CHECKS

1. Stand to the side of the wheels when starting up.
2. Let the wheels gain maximum speed before starting to grind.
3. Do not grind on the side of the wheel.
4. Small objects must not be held by hand.
5. Never leave the machine running unattended.
6. Do not bend down near the machine while it is running.
7. Never force the work-piece against a wheel.
8. Slowly move the work-piece across the face of the wheel in a uniform manner.
9. Never place a rag near the rotating stone.
10. Grind only appropriate materials that is designated for the grinding stone.
11. If grinding aluminum seek direction from technician.

HOUSEKEEPING

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

POTENTIAL HAZARDS

- Hot Metal
- Sparks
- Noise
- Sharp edges and burrs
- Entanglement
- Wheels 'run on' after switching off
- Eye injuries
- Do not grind non-ferrous metals
- Respiratory irritation

7.6 Vertical Belt/Disk Sander

This machine is used for removing metal burrs and small amounts of material after saw-cutting operations. As well, it can be used for making radii. The belt on this machine travels straight down into the table. This makes the machine safer to use for small parts. At the side of the machine is a disk sander that rotates counter clockwise. The disc can also be used for small part sanding.



DO NOT use this machine unless the technician has instructed you in its safe use and operation.

PPE REQUIRED

- Safety glasses must be worn at all times in work areas.
- Long and loose hair must be contained.
- Close fitting/protective clothing must be worn.
- Never wear rings or jewelry while operating the sander.
- CSA approved footwear.
- Hearing protection should be used when noise levels exceed 85 dBA.
- Gloves should not be worn except authorized by technician.

PRE-OPERATIONAL SAFETY CHECKS

1. Check that the work-piece does not have any protruding nails, staples, screws, etc. This can damage the sanding belt or disc.
2. Locate and ensure you are familiar with the operation of the ON/OFF switch.
3. Ensure no slip/trip hazards are present in workspaces and walkways.
4. Faulty equipment must not be used. Immediately report any suspect machinery.

OPERATIONAL SAFETY CHECKS

1. Keep your fingers at least 1" (25mm) away from the belt at all times.
2. Let the sand paper gain maximum speed before starting to sand.
3. While using the disk sander, do not use the right side of the disc because it will lift your material off the table.
4. Always be aware of where your fingers are in relation to the disc/belt.
5. Do not bend down near the machine whilst it is running.
6. Do not sand pieces of material that are too small to be safely supported.
7. Do not remove jammed material while the sander is on. Turn off power, and wait until the machine has stopped.
8. Do not adjust the tables while machine is running.
9. Do not put excessive pressure on the sanding belt or disc.
10. Never leave the machine running while unattended.
11. Do not use sander if the belt or disc is cut or torn.
12. Do not grind non-ferrous metals

HOUSKEEPING

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

POTENTIAL HAZARDS

- Hot metal
- Sparks
- Noise
- Sharp edges and burrs
- Entanglement
- Wheels 'run on' after switching off
- Eye injuries
- Respiratory irritation

7.7 Deburring Wheel Machine

This machine is used to remove metal burrs on small to middle parts without removing stock material. Deburring wheels are used for deburring, finishing, polishing, blending and cleaning on a wide variety of substrates such as metals, composites, plastics, glass and wood. Light tool pressure will minimize undercutting or gouging and provide an extremely consistent finish.

DO NOT use this machine unless the technician has instructed you in its safe use and operation.

PPE REQUIRED

- Safety glasses must be worn at all times in work areas.
- Long and loose hair must be contained.
- Close fitting/protective clothing must be worn.
- Never wear rings or jewelry while operating the sander.

- CSA approved footwear.
- Gloves should not be worn except authorized by technician.

PRE-OPERATIONAL SAFETY CHECKS

1. Check that the work-piece does not have any protruding nails, staples, screws, etc.
2. Locate and ensure you are familiar with the operation of the ON/OFF switch.
3. Ensure no slip/trip hazards are present in workspaces and walkways.
4. Faulty equipment must not be used. Immediately report any suspect machinery.

OPERATIONAL SAFETY CHECKS

1. Let the deburring wheels gain maximum speed before starting to deburr.
2. Do not bend down near the machine whilst it is running.
3. Never force the work-piece against a deburring wheel.
4. Keep your fingers at least 1" (25mm) away from the deburring wheel at all times.
5. Never leave the machine running while unattended.

HOUSKEEPING

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

POTENTIAL HAZARDS

- Hot Metal
- Sharp edges and burrs
- Entanglement
- Wheels 'run on' after switching off
- Eye injuries
- Respiratory irritation

7.8 Pan Brake / Air Brake

A brake is a metalworking machine that allows the bending of sheet metal. A cornice brake only allows for simple bends and creases, while a box-and-pan brake also allows one to form box and pan shapes.



DO NOT use this machine unless the technician has instructed you in its safe use and operation.

PPE REQUIRED

- Safety glasses must be worn at all times in work areas.
- Long and loose hair must be contained.
- SA approved footwear.
- Close fitting/protective clothing must be worn.
- Never wear rings or jewelry while operating the pan brake.
- Gloves should be worn when handling material that is sharp.

PRE-OPERATIONAL SAFETY CHECKS

1. Guards or safety devices must never be removed or adjusted.
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. Familiarize yourself with and check all machine operations and controls.
6. Faulty equipment must not be used. Immediately report suspect machinery.

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 that the work-piece 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.
4. Disconnect airline if equipped and put back in proper place.

POTENTIAL HAZARDS

- Sharp edges and burrs
- Squash/crush and pinch points
- Impact from counterweight

8.0 Hand Tools – Powered

8.1 General Safety for Handheld Power Tools (corded, cordless or air powered)

1. Eye protection is required when using these tools.
2. CSA approved footwear.
3. Hearing protection should be used when noise levels exceed 85 dBA.
4. Gloves should not be worn except authorized by technician
5. Stay focused on the tool and the work being performed.
6. Keep work area clear of other tools and materials.
7. Use the right tool for the job. Seek help if you are unsure of tool operating procedures.
8. Keep hands and fingers clear of the tools' blade or bit and cutting path.

9. Secure work to bench when using electric hand tools.
10. Do not over-reach with electric hand tools.
11. Make all adjustments on the tool with the power cord unplugged.
12. Do not carry plugged in tools with finger on power switch.
13. Use only grounded extension cords.
14. Always keep tool guards in place.
15. Let the tools' bit or blade do the work. Do not force tools into the material.
16. Unplug, clean and put away tools when finished working.
17. Never perform any operation unless you are entirely sure as to how to perform it properly and safely. Make use of a dry run or practice run.

8.2 Drill

PPE REQUIRED

- Safety glasses must be worn at all times in work areas.
- CSA approved footwear.
- Hearing protection should be used when noise levels exceed 85 dBA.
- Gloves should not be worn except authorized by technician.
- Long and loose hair must be contained.
- Close fitting/protective clothing must be worn.
- Never wear rings or jewelry when operating the drill.



PRE-OPERATIONAL SAFETY CHECKS

1. Select the proper size and type of bit for the job. Make sure it is sharp and not damaged.
2. Inspect for frayed or damaged power cord.
3. Inspect on / off switch for proper operation.

OPERATIONAL SAFETY CHECKS

1. Stay focused on the tool and the work being performed.
2. Make sure drill is tight in chuck.
3. Do not use excessive force into hard material as the bit might break.
4. Keep hands and fingers clear of tool bits.
5. Always ensure that speed and pressure are correct for the material and drill diameter being used.

HOUSEKEEPING

1. Leave the machine in a safe, clean and tidy state.
2. Put tooling back in the right spot.

POTENTIAL HAZARDS

- Hot Metal
- Noise
- Sharp edges and burrs

- Entanglement
- Spindle 'run on' after switching off
- Eye injuries
- Electrocutation from power faults, faulty equipment or incorrect use

8.3 Angle Grinder

An angle grinder is a handheld power tool used for cutting, grinding and polishing. The motor drives a geared head at a right angle on which is mounted an abrasive disc or a thinner cut-off disc, of which can be replaced when worn. Angle grinders typically have an adjustable guard and a side-handle for two-handed operation. Certain angle grinders, depending on their speed range, can be used as sanders, employing a sanding disc with a backing pad or disc. The backing system is typically made of hard plastic, phenolic resin, or medium- hard rubber depending on the amount of flexibility desired.



PPE REQUIRED

- Long and loose hair must be contained.
- CSA approved footwear.
- Hearing protection should be used when noise levels exceed 85 dBA.
- Gloves should not be worn except authorized by technician.
- Close fitting/protective clothing must be worn.
- Never wear rings or jewelry when operating the angle grinder.
- When using an angle grinder, wear safety goggles or a face shield over safety glasses
- Dust mask must be used when cutting material that makes airborne particles.

PRE-OPERATIONAL SAFETY CHECKS

1. Never operate without the guard in place and make sure the guard is secured.
2. Inspect for frayed or damaged power cord.
3. Inspect on / off switch for proper operation.
4. Remove all wrenches and other tools from the machine before turning the power on.

OPERATIONAL SAFETY CHECKS

1. Be aware of torque reaction when starting. Hold the tool firmly with both hands.
2. Always be aware of where your fingers and the power cord are in relation to the cutting disc.
3. When finished, make sure that the grinder has completely stopped before you lay it down.
4. Use only in a designated grinding area – erect screens if necessary.
5. Use the designated grinding disc for the material you are working with.
6. Ensure that the grinding disc, guard and attachments (including handle) are secure and correctly fitted.
7. Inspect the grinding disc for damage. Do not use any grinding disc that is damaged.

8. Always inspect the work-piece to ensure that there are not any items that might damage the grinding wheel or cause injury to the operator.
9. Secure and support the work-piece using clamps, bench vises, etc.
10. Ensure all other students are clear of the immediate work area.
11. Never make adjustments while the angle grinder is running.
12. Allow the angle grinder to reach operating speed before applying it to the work- piece. Increase the load gradually.
13. Do not lift or drag angle grinders by the cord.
14. Keep flexible electrical cords clear of oil, grease, machines and sources of heat.
15. Be aware of flying sparks. Hold grinder so that sparks fly away from you, other people and flammable materials.
16. Do not touch the work-piece immediately after grinding operation as it may be extremely hot.

HOUSEKEEPING

1. Avoid trip hazards and prevent damage to electrical cords.
2. Do not walk on, wheel objects over, or drop materials/tools on flexible electrical cords.
3. Clean bench and work area and place all waste material in appropriate bin.
4. Put tools back in correct storage place and roll up extension if used.

POTENTIAL RISKS AND HAZARDS

- Moving and rotating parts
- Movement of work-piece
- If work-piece is not clamped securely when using a cut-off wheel the wheel may bind and can shatter.
- Inhalation of fumes and dust particles
- Burns from hot materials or friction
- Electrocutation from power faults, faulty equipment or incorrect use

8.4 Die Grinder / Rotary Tools

Die grinders are handheld power tools used for grinding, sanding, honing, polishing, or machining material (typically metal, but also plastic or wood). All such tools are conceptually similar, with no bright dividing line between die grinders and rotary tools, although the die grinder name tends to be used for pneumatically driven heavy-duty versions whereas the rotary tool name tends to be used for electric lighter-duty versions.



PPE REQUIRED

- Safety glasses must be worn at all times in work areas.
- Long and loose hair must be contained.
- CSA approved footwear.
- Hearing protection should be used when noise levels exceed 85 dBA.

- Gloves should not be worn except authorized by technician.
- Close fitting/protective clothing must be worn.
- Never wear rings or jewelry when operating the rotary tool/die grinder.

PRE-OPERATIONAL SAFETY CHECKS

1. Be sure switch is in the off position before plugging the tool in.
2. Inspect for frayed or damaged power cord.
3. Inspect on / off switch for proper operation.
4. Remove all wrenches and other tools from the machine before turning the power on.

OPERATIONAL SAFETY CHECKS

1. Use clamps or other means to properly secure work-piece.
2. Do not force the tool.
3. Disconnect the power before making any adjustments or changing accessories.

9.0 Safety Guidelines for Hand Tools

9.1 Chisels

1. Wear eye protection when hammering on chisels and punches or on metal objects. The hardened face of a hammer, or the end of a tool, may chip or shatter to send metal fragments flying.
2. Always clamp the work securely in a vise or to the bench top.
3. Always cut with the blade pointing away from your body and keep your hands behind the cutting edge.
4. Do not use a wood chisel as a pry bar or a wedge.
5. Do not use a wood chisel on metal.
6. Do not use an all-steel chisel with a mushroomed face or a chipped edge.



9.2 Files

A file without a handle can be extremely dangerous. Keep a handle on every file to prevent the tang from piercing the palm or wrist if the file should slip or catch. Use a vise to secure the material being filed. Always file in a forward direction (away from you). A file cuts in one direction only.



9.3 Wrenches

Wrenches are the cause of many cut and skinned knuckles. When ever possible, pull the wrench toward you. If you must push on a wrench, use the open palm of your hand to avoid hitting your knuckles if you slip. Make sure that the wrench is the proper size for the bolt or nut. When using adjustable wrenches, keep the open jaw of the adjustable wrench facing toward you



when pulling. This forces the movable jaw onto the nut to reduce its tendency to slip. It also prevents damage to the wrench.

9.4 Hammers

Check the fit and condition of the handles. Keep handles tightly wedged into the heads to prevent injury to you and others nearby. Never use a hammer to strike another hammer. Replace cracked or splintered handles. Select the right size for the job, a light hammer bounces off the work. One that is too heavy is hard to control.



10.0 Housekeeping

Each person is personally responsible for clean-up and tool return. Each machine and work area should be cleaned up immediately after use. The last person to use a machine is responsible for cleaning the machine and surrounding area.

11.0 Acknowledgements

Thank you to Heinz Koller at the University of Waterloo for providing a base template for the Integrated Research and Machining Centre Safety Manual. Some definitions sourced from Wikipedia.

If you have any comments regarding this manual, or you require further information regarding training, please contact:

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Appendix A

Integrated Research and Machining Centre

POLICY ACKNOWLEDGEMENT FORM

The Integrated Research and Machining Centre (IRMC) requires all users to meet the following requirements.

- Read the IRMC Safety Manual
- Completed the IRMC Safety Orientation

ACKNOWLEDGEMENT OF REQUIREMENTS:

All requirements must be completed and initialed before access will be granted to the IRMC facilities and equipment.

I confirm that I am a current student or an employee at UBCO _____

I confirm that I have read and understand the IRMC Safety Manual _____

I confirm that I have received the IRMC Safety Orientation and have
been shown first aid kit and eye wash station locations _____

I have reviewed this document and I understand and agree to its
requirements. _____

Printed Name _____

Signature _____

Date _____

Shop Technician _____