

DFL



WATERLOO | **ARCHITECTURE**
DESIGN FABRICATION LABS
SAFETY MANUAL

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1.0 Fabrication Lab Safety

This manual is meant as a basic guide to the machinery available in the shop and the basic rules for operating that machinery. Due to the diverse nature of the work that is done in the shop and the dynamic properties of the materials being used, it is impossible to create safety guidelines that cover every eventuality. Most importantly this guide cannot replace the advice and instructions given by the shop supervisor, your most important resource for working safely in the shop.

The DFL is potentially hazardous environment. As such, it is extremely important that all safety rules and instructions by the shop supervisor be followed. However, it is the student who is ultimately responsible for his or her own safety. If you are ever unsure of anything you want to do in the shop, just ask. Even if you are embarrassed to ask, we would rather answer “stupid” questions than pick a finger up off the floor. You also have the same responsibility to yourself with regards to substances and sleep deprivation. The supervisor can't always tell if someone is high or drunk or too tired to be working. You have to make your own call if you are able to safely work. There's no deadline important enough to risk an accident for.

1.1 Guests & Visitors

No unauthorized person shall use the DFL. (Guests are prohibited to use any shop tools or equipment). Persons who has completed the Shop Orientation, Shop Test and signed a Shop User Safety Agreement may accompany shop guests and visitors. He or she is responsible for that guest/visitor. Guests and visitors are not permitted to use any machines or tools and are not allowed in any machine use areas. Visits should be as brief as possible.

1.2 DFL Occupancy

The primary responsibility of Shop Attendants is to monitor the safety of shop users. The number of users which an individual supervisor can effectively monitor is affected by many factors. It shall be each Lab supervisor's responsibility to determine how many users they can effectively monitor under any given circumstances.

Generally, each shop attendant should be able to

monitor 15-20 users. This limit may be adjusted upward or downward at the Shop Attendant/s discretion dependant upon conditions.

The maximum number of students allowed in the shop depends upon the given project/projects. To determine a safe number of users at any time, the supervisor will consider the project size, the skill levels of the students, and other relevant factors. If the supervisor observes that there are an excessive number of students in the shop, they maintain the right to ask that the appropriate number of students to volunteer to leave the shop until occupancy returns to more appropriate levels. The supervisor's decision is final.

A maximum of 40 students will be allowed in room 1006 at any given time.

Application of this policy will be left to the discretion of Shop Attendant(s) on duty. Resolution of any disputes regarding the application of this policy shall be the responsibility of the DFL Manager in conjunction with the AO and the Director.

Please consider these occupancy limits when assigning projects and deadlines.

Notify DFL manager of expected heavy lab use so that adequate staff can be scheduled. If Lab occupancy is expected to exceed 40 users as a result of your class, you should make arrangements for additional shop attendants to be scheduled 2 weeks prior to the day of expected shop use.

1.3 WHMIS

All students studying within the Faculty of Engineering must have appropriate instruction on The Workplace Hazardous Material Information System (WHMIS). This requirement is obtained by completing an on-line WHMIS tutorial and test. Those who do not have a WHMIS credit will not be granted access to the DFL facilities.

1.4 Orientation & Training

New students receive orientation where they are shown the layout of the machine shop, identification of all the machinery, cutting tools, hand tools, First

Aid Kit, fire extinguishers, Emergency Shut-offs and Eye Wash Station. Brief explanations as to how the machines are used. Focus is on safety and working safely. Student will be required to sign off on an acknowledgment form upon completion.

All persons that use the shop must complete the basic orientation, test, and sign the acknowledgment form. Students who have not participated in the orientation or have not submitted a signed form will be prohibited in using the power equipment.

All requirements of shop certification must be completed within the same semester.

Shop users must have on file with the shop manager a signed and dated copy of the Shop Users Safety Agreement form.

Individuals must receive additional instruction for machines not included in the standard orientation.

All Graduate and transfer students will be required to take the orientation and training again to refresh their knowledge and understanding of the safe and proper use of the equipment. Arrangements will need to be made with the Graduate Student Services Coordinator and the DFL Manager.

1.5 First Aid

In the event of an injury occurring when the shop is not supervised, one student will lie or sit the student down in a prone position to avoid collapse and possible concussion, and apply First Aid, while a second student if available, is to locate the Commissionaire or office staff to continue First Aid attention.

Contact local emergency by phoning 911

The First Aid cabinet and Eye Wash station are located by the sink at the north-west corner of the shop (First Aid equipment and materials are strictly for first aid emergencies)

Large red Emergency power shut off buttons are located around the DFL as shown on the floor plan. If

you observe that an injury is about to occur and you are unable to stop the user in time, or in the event of an injury on any of the machines, hit the nearest shut off button.

1.6 Injury-Causing Accidents

In the event of an injury, inform the shop supervisor immediately. The supervisor will provide appropriate First Aid treatment and arrange for transportation to the Hospital if required. Students should be prepared to assist if necessary.

In the event of an amputation, the severed section should be kept cold and brought to the hospital with the victim as soon as possible. 'Cold Paks' are supplied in the First Aid cabinet, and these provide sufficiently cold temperatures to preserve the severed section.

It is recommended that antiseptics not be used on any wound, they may cover the wound or require extra clean up by medical staff in the emergency room. Washing in cold water and wiping with sterile wipes provided in the cabinet are the only actions required.

All incidents must be reported and have a University of Waterloo Incident Report filed. A supervisor must complete the incident report with the victim within 24 hours following the injury.

All injury-causing accidents requiring outside medical attention requires a meeting with and the shop manager to determine the cause of the accident and as a preventative measure against similar accidents in the future before shop access may resume.

1.7 Non-injury Accidents

In the event of accidents resulting in machine damage, material "kick-backs," jamming, or other unsafe events, it should be reported to a Lab Supervisor immediately. The circumstances will be reviewed and recommendations made for safe operation of the equipment. If gross negligence is determined to be involved in the course of a non-injury causing accident a meeting is required between the user(s) involved in the accident and the DFL Manager before shop access may resume.

2.0 General Safety Rules

1. Students must fully co-operate with the shop supervisor and must follow the rules without exception. Students are expected to report any accident regardless how minor. Minor cuts or abrasions are treated on-site. We advise students of health and safety on campus.
2. Do not enter shop while tired or under the influence (Drugs, Alcohol, and any Medications causing Drowsiness)
3. It is the student's responsibility to receive and understand instruction in the proper use of any and all tools and equipment available in the Shop before he or she attempts to use the tools or equipment.
4. All students using the DFL or hand tools must wear safety glasses, goggles or face shield to protect their eyes
5. Shoes covering the entire foot must be worn at all times when in the shop. No open heels, toes or sides of the foot will be accepted. Students will not be allowed to work if not appropriately attired.
6. Hair should be tied back. Dangling jewelry must be removed. Avoid loose clothing: adjust to keep cuffs, drawstrings out of hand's way
7. Ear protection is encouraged but not mandatory.
8. Dust Masks are encouraged when you are cutting plywood, MDF or particleboard
9. All materials must be kept off the floor and all tools need to be put away at the end of each work period.
10. Sawdust and scrap material must be cleared away after each use
11. No treated wood or wood products can be processed in the DFL areas.
12. Questions regarding safety issues, either in the shop facility or in a student's studio can usually be answered by the instructor, or by the DFL staff.
13. Cell phones and MP3's are prohibited in the machining area: your complete focus & attention is necessary.
14. No spray painting in the shop.
15. Use extreme care that all lumber is free from nails, bolts, metal or loose knots before machining.
16. Keep your work area free of debris clean up immediately after finishing at a tool or work area.
17. Make sure you are comfortable with the operation of any tool or piece of equipment. If you are unfamiliar with a particular operation, seek assistance from the technician.
18. Report any damaged equipment or strange sounding equipment immediately to the DFL staff.
19. Never have a conversation with, or otherwise distract someone, while operating machinery
20. Do not attempt repairs to any equipment that is broken. Notify DFL staff or assistants for help.
21. Report accidents to the DFL staff immediately
22. Machines that are unplugged may be in need of repair. Never plug in a machine that has been disconnected, ask the supervisor first
23. Hands should never come within 6" or 15cm of any blade, use a push-stick instead
24. Horseplay, running, yelling and/or fighting are absolutely forbidden in the shop.
25. Do not use stationary equipment work surfaces for sanding, project assembly, layout, applying finishes, etc. or for uses other than their intended purpose.
26. All safety guards must be kept in place while operating equipment. If a guard or safety device is an impediment to safe operation of a machine seek help from shop staff.
27. Never make an adjustment to knobs or handles marked with red tape
28. Do not use broken or damaged equipment; report immediately to manager
29. Do not use previously painted or finished wood in the shop.
30. Do not use pressure treated (green treated) lumber in the shop.
31. Do not pour solvent or oil-based chemicals in sink.
32. Do not wash brushes containing solvent or oil-based chemicals in sink
33. Do not use plaster or any cementitious material on any power machines
34. Make sure machine's work surface is unobstructed and clean before use

35. Personal power tools are prohibited in the School. The only exceptions being hand sanders and drills and dremel tools
36. Shut the power off when you are finished or if you are leaving the machine, never leave the machine running unattended
37. Materials should never be fed into a machine faster than it will cut or sand
38. To protect everybody's health, no grinding/sanding of toxic materials such as concrete or fiberglass is permitted

3.0 Operation and Equipment Safety

The most common types of operations performed in the shop usually fall under one of these categories:

Cutting

- Ripping (cutting lengthwise) - Table saw
- Crosscutting (cutting widthwise) – Radial Arm saw, Mitre saw
- Curved cuts – Bandsaw, Scroll saw
- Beveled or angled cuts – Table saw (see supervisor first)
- Grooved cuts – Table saw (see supervisor first)

Boring

- Drilling holes – Drill Press
- Mortising (making square holes) – Hollow Chisel Mortiser

Sanding

- Edge sanding: Edge Sander
- Surface sanding: Dependant on size
- Specialized sanding

Shaping

- Routing Profiles - Router
- Lathe Turning (creating cylinders)

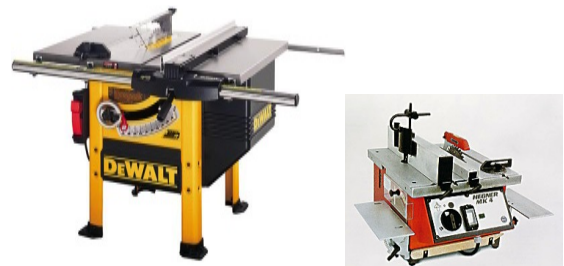
Surfacing

- Planing surfaces (removing thickness) - Planer
- Jointing faces or edges (flattening boards) - Jointer

4.0 Cutting

4.1 Table Saw: Ripping Cuts

The most common piece of equipment in many workshops is the table saw. The DFL have four available to use, two small saws (a.k.a. The Ken and Barbie saws,) a medium sized 10" Dewalt, and a large 14" General table saw. Most of the work done on these saws will be ripping cuts, or cuts made parallel to the long side of the board. These saws all operate in exactly the same way and the following safety rules are all important regardless of which saw you may be using.



SAFETY

1. Materials must always be supported against a fence during cutting. Fee-hand cutting on a table saw is strictly forbidden.
2. The longest edge of a workpiece is the side that must be supported by the fence, never the shortest.
3. The supported edge must be straight
4. Always push on the side of the material that is between the blade and the fence
5. Blade height should be roughly 1/4" or 6mm over the height of the material. |
6. Always push material past and clearing the blade when finishing the cut
7. Never place your hands in the path of the saw blade
8. Do not over reach behind or over the blade unless the blade has stopped turning
9. Wait for the blade to stop spinning before removing your work
10. Ask for help cutting large sheet goods, not to pull, but to support material
11. If the edge of the material is warped, see the shop supervisor for solutions
12. Do not adjust the fences until blade comes to a complete stop

13. Do not remove jammed wood while saw is still on. Wait until blade comes to a complete stop
14. Do not start saw with wood in contact with blade
15. Always be aware of where your fingers are in relation to the blade and blade guard
16. Use push sticks when ripping narrow stock
17. Do not adjust the height or angle of blade while machine is running
18. Do not stack material to be cut on the table saw. Cut only one piece at a time
19. Never use the fence as a cutoff gauge when crosscutting, as this can bind the blade. This WILL cause kickback of the wood at extremely high velocities

Tips: Although it's tempting to use the small saws for the majority of work as they seem less frightening, they should never be used to cut materials thicker than ½" or 12mm. The small saws will remove 1/8" or 3mm of material as they cut; the large saws remove up to 3/16" or 4 - 5mm. Plan for this during the layout of your cuts.

4.2 Radial Arm Saw: *Cross Cutting*

Designed to cut across the width of materials, this saw will cut pieces up to 24" or 60cm wide. This saw requires no adjustment for the average cut, only the work piece is adjusted relative to the blade.



SAFETY

1. The long edge of the material must be supported on the fence
2. The edge supported by the fence must be straight
3. While pulling the saw over the material, never let go of the handle until the cut is completed and the saw is off and back in its original position

4. Leave the saw running until you've completed the cut and it's back in its original position
5. Never cross your arms while holding the piece and pulling the saw, simply switch hands instead

Tip: The saw will remove 3/16" or 4-5mm per cut. Plan for this when you do layout.

4.3 Mitre (Chop) Saw: *Cross cutting*

This performs the same type of cut as the radial arm saw, but operates on a pivot instead of a sliding rail. It will cut pieces up to 7" or 17cm wide. The saw also turns to the right or left and allows the cutting of various angles up to 45°.



SAFETY

1. The long edge of the material must always be supported by the fence
2. The edge that is supported by the fence must be straight
3. Always be aware of where your fingers are in relation to the cutting blade. Keep your free hand off the cutting table
4. Leave the saw running until you lift it out of the material
5. Do not cross the cut line of the blade with your free hand. If your left hand is on the handle, DO NOT hold the wood on the left side of the saw with your right hand, switch hands instead
6. Do not start saw with wood touching the blade
7. Never place your hands closer than 6" from the blade
8. Do not start cutting until the blade is moving at full speed
9. Do not remove jammed wood while saw is still on. Turn off power and wait until the blade completely stops

10. Avoid unintentional starting. While checking for blade placement relative to cut line, do not keep your finger on switch
11. Do not lift blade guard with you hands. Blade guard will raise automatically when handle is lowered
12. Do not cut metal with this saw

Tip: The saw will remove 3/16” or 4- 5 mm per cut. Plan for this in your layout.

4.4 Panel saw: *Ripping and Cross cutting large panels*

Although panel and table saws both have the same safeguarding requirements, they are intended for different applications. Panel saws are most often used for cutting large composite panels using the sliding rails to guide the saw, while table saws are used for a wide range of general cutting applications. The difference is significant, largely because the design and use of a panel saw means that the operator’s hands are usually well away from the blade, reducing the risk of injury. This is one of the main reasons why there are far fewer injuries involving panel saws than table saws. Cutting full size panels on the table saw can be fairly awkward. The panel saw performs the same basic types of operations as the table and radial arm saw, but makes cutting large materials easier as they stand on edge as it cuts. While it is not recommended for accurate cutting, it is a good machine start on to rough-cut panels to size.



SAFETY

1. When cross cutting, make sure you bring the saw down as far as it will go to ensure a full cut
2. When ripping, have someone help you pull or push the material through.

4.5 Bandsaw: *Curved, Straight and specialized cutting*

A very versatile machine, the bandsaw can be used for a wide variety of operations. Its main use is for

cutting curves or for cutting straight lines on pieces that do not have the straight edge required for any circular saw blade. It does have fences for straight cutting, however the blade cuts straight downwards into the table making free hand cuts possible. The only real drawbacks to the bandsaw are cut accuracy (which depends on the user,) and the finish quality of the cuts.



SAFETY

1. Make sure to lower the blade guard (by loosening the T-knob at the upper back and then pulling it down by hand,) so that it is about ¼” or 6mm above your work
2. Do not adjust guard until blade comes to a complete stop
3. Always be aware of where your fingers are in relation to the cutting blade. Never have them in line with the blade
4. Never start saw with wood touching the saw blade
5. Turn off the machine if the blade breaks
6. Never pull out a broken blade from material while the saw is still on
7. Never cross cut round objects (such as tubes) with the bandsaw. The downward action of the blade will turn the work piece quite easily
8. Push the stock through the blade with your hands on both sides of the line of cut or, preferably, use a push bar designed for this purpose
9. Do not push with excessive force as this leads to slipping or to blade failure. If excessive force is required to cut, either the blade is dull and needs to be replaced, or the material is too hard for the saw.
10. Excessive guard clearance can lead to serious accidents. Always lower the guard so that it just clears the work and return it to its lowest position when you have completed your cut.

Tip: When cutting curves or straight lines on the bandsaw leave a little extra material on your cut line and then use the edge sander to remove the excess.

4.6 Scroll Saw: *Curved and specialized cutting*

A scroll saw is an electric saw useful for cutting intricate curves where a jigsaw or coping saw is not appropriate. It is somewhat similar to a bandsaw, but the bandsaw blade is a continuous loop. Scroll saws use saw blades similar to those used by coping saws and operate through a quick reciprocating up and down motion. This is probably one of the safest cutting tools in the shop.



SAFETY

1. When making any adjustments, performing maintenance, or changing the blade, ensure the power is off and the cord is unplugged
2. Confirm the blade is the proper type for the cut you are planning
3. Insert the blade with the teeth pointing forward and down to the table
4. Maintain the proper blade tension.
5. Always clear off the table before starting the machine
6. Never start the machine until all handles are locked
7. Never reach under the table while the machine is running
8. Always keep your hands and fingers away from the blade; follow the 3" rule
9. Never place your hands or fingers directly in line with the blade path where they could be injured if you slipped
10. Do not start the machine with the blade in contact to the workpiece.
11. Hold the work firmly against the table.

5.0 Boring

5.1 Drill Press: *Drilling Holes*

A simple machine, the drill press is capable of drilling holes up to 3" or 7.5cm in diameter, or cutting disks up to 6" or 15cm in diameter. It is usually necessary to clamp your piece to the bed of the press and to always have a scrap piece of wood underneath your work for when the drill bit goes through your piece.



SAFETY

1. Always be aware of where your fingers are in relation to the drill bit
2. Do not use bits that are dull, bent or damaged
3. Make sure the bit is centered in chuck and tightened with the chuck key before starting the drill
4. Do not leave chuck key in chuck
5. Use clamps or a vice to hold your work when drilling metal, this will help prevent the material from spinning into your body or hand
6. When drilling metal, check with the supervisor first to determine the best tool and speed
7. Do not hold metal in your bare hand while drilling
8. Do not turn the drill press "on" before clearing the table of all objects (tools, scrap pieces, etc.)
9. Always let the drill come to a complete stop on its own. Never grasp the chuck in an attempt to stop the drill
10. Avoid awkward hand positions where a sudden slip could cause a hand to move into the drill bit or cutting tool
11. Do not attempt to drill material that does not have a flat surface, unless a suitable support is used
12. To prevent rotation of the workpiece, clamp work securely to the table if it is too short to contact

the column or when using a hole saw or cutting tools larger than 1/2" diameter

13. Do not wear gloves, neckties, or loose clothing when operating the drill press

Tip: Use a centre punch to mark your holes. This will help the tip of the drill bit align with centre more accurately.

5.2 Hollow Chisel Mortiser: *Square holes*

Although it seems impossible, the mortiser is able to make square holes of a few different sizes. This is achieved using a combination of a specialized drill bit and a square chisel that acts much like a hand held chisel would. By pressing down firmly and lifting, square holes can be made up to 2" or 5cm deep.



SAFETY

1. Be careful of the bottom of the chisel as it is razor sharp
2. The depth gauge at the right hand side of the machine will help to control the depth of your cuts
3. Make all machine adjustments or maintenance with the machine unplugged
4. Remove adjusting keys and wrenches from the machine before turning it on
5. Keep safety guards in place at all times when the machine is in use
3. Make sure the mortiser is firmly secured to the table or bench before use
6. The auger bit should extend 1/16" - 1/8" beyond the end of the chisel for clearance.
7. Keep your hands at least 3" away from the chisel while operating the machine

Tip: The mortiser has a tendency to stick in the material after each pass. Use a mallet or block of wood to gently tap equally on

each side of the material or wiggle it with your hands (being wary of the chisel) until it comes off.

6.0 SANDING

6.1 Edge Sander: *Edge sanding*

This machine will sand straight edges of up to 40" or 1m in length and inside radii as small as 3" or 7.5cm. The belt on the machine is usually 80 -100 grit and is very aggressive; it's easy to remove too much material accidentally. Care should be taken to hold on to your work firmly, if you don't, the machine could throw the material possibly pulling your hands towards the belt. It is not a good idea to sand small parts on this machine. Face sanding thin parts can also be dangerous as there is a lot of gripping surface on the face for the belt to 'grab' the work and little room for your fingers to grip the workpiece. The close proximity of the finger to the belt in this scenario can be dangerous.



SAFETY

1. Keep your fingers at least 1" or 2.5cm away from the sanding belt at all times
2. Keep a firm hold on the material
3. Never face sand. Sanding the broad face of a board while trying to hold it by the narrow edge is asking for trouble.
4. Do not sand the narrow ends of your board, the sideways action of the belt could grab the material
5. Do not sand metal on this machine You must use the appropriate grinder from the metal shop
6. Check that the workpiece does not have and protruding nails, staples, screws, etc. This can damage the sanding belts or discs or sparks may start a fire

7. Do not wear gloves when using this machine
8. Turn on the dust collector attached to this machine when sanding
9. Always be aware of where your fingers are in relation to the sand paper
10. Do not remove jammed wood while sander is on. Turn off power, and wait until machine has stopped
11. Do not adjust the tables while machine is on
12. Do not put excessive pressure on the belt
13. Always turn the machine 'OFF' if you need to step away
14. Do not use sander if the belt is cut or torn

Tip: It's tempting to try and sand the top and bottom faces of boards on this machine, but the average board thickness of $\frac{3}{4}$ " or 19mm means your fingers would come very close to the belt. Sanding injuries are far more painful and take longer to heal than cuts, try the hand-held palm sander instead.

6.2 Vertical Belt/Disk Sander: *Small edge sanding*

The belt on this machine travels straight down into the table instead of left to right like the edge sander. This makes this machine much safer to use for small parts although its sanding capacity is quite reduced. At the side of the machine is a disk sander that rotates counterclockwise and can also be used for small part sanding.



SAFETY

1. Keep your fingers at least $\frac{1}{2}$ " or 12mm away from the belt at all times.
2. While using the disk sander, be careful of the right side of the machine as it will lift your

- material off the table as the disk is traveling upwards at this point
3. Do not sand metal on this machine. You must use the appropriate grinder in the metal area of the lab
4. Check that the workpiece does not have any foreign materials (nails, staples, screws, etc.) This can damage the sanding belts or discs or cause fire prone sparks
5. Do not wear gloves when using this machine
6. Turn on the dust collector
7. Always be aware of where your fingers are in relation to the sand paper
8. Do not sand pieces of material that are too small to be safely supported
9. Do not remove jammed wood while sander is on. Turn off power, and wait until machine has stopped
10. Do not adjust the tables while machine is running
11. Do not put excessive pressure on the sanding belt or disk
12. Always turn the machine 'OFF' if you need to step away for a moment
13. Do not use sander if the belt or disc is cut or torn

6.3 1" Belt Sander and Spindle Sander

The 1" belt sander is commonly used for sanding the ends of small parts and works much like the larger sanders. This sander also has a small disk sander on the side of the machine, which operates just like the larger disk sander.



SAFETY

1. Keep fingers $\frac{1}{2}$ " or 12mm away from the sanding surface at all times
2. Do not sand very small or very thin work pieces that cannot be safely controlled. Loss of control of the workpiece can result in injury.

3. Always feed the workpiece against the direction of the sanding belt rotation.
4. Do not put excessive pressure on the sanding belt or disc.
- 5.

6.4 Spindle Sander

Primarily used for edges and irregular curves. The spindle oscillates up and down while rotating and is ideal for sanding the inside radii of curves. The spindle diameter is interchangeable from ¾" (19mm) to 3" (7.5cm) in diameter. Ask for assistance with spindle change. Sand the workpiece against rotation of spindle. Care should be taken when sanding interior holes.



SAFETY

1. Before turning on the spindle sander, make sure your stock is not touching the spindle
2. After the spindle sander has been turned on, wait to sand your stock until the machine has come up to full speed
3. Sand using light pressure against the rotation of the spindle
4. Keep fingers at least 1 inch away from the spindle at all times.
5. Be careful not to allow your stock to get caught between the spindle and the opening in the table
6. Keep stock moving across the spindle to avoid loading up, wearing out, or burning of the abrasive sleeve
7. Keep stock on the table while sanding
8. Never sand very small pieces with the spindle sander
9. Trapped pieces between the spindle and the table should not be moved until the sander is turned off and it stops
10. When finished with the sander, turn it off

7.0 Shaping

7.1 Router: Profiling

The router is most commonly used for creating decorative profiles on edges, although it also has many specialty uses. When profiling, there are a number of different bits that can be used to create different effects or shapes. There are 5 routers in the shop; two are part of the small table saws, two with plunge capability and one allocated to the router table. Always check with the shop supervisor before using these machines, as the type of operation they are performing will determine the specific safety rules to be followed.

The direction of feed is very important when routing and can make the difference between a clean cut and a ruined project. A general rule is to move the router in a counterclockwise direction on a outside cut and a clockwise direction on an inside cut



SAFETY

1. Unplug tool when you need to change the bit or adjust the bit depth in the collet
2. Always hold the router by the handles when in use
3. Do not start cutting with the router bit in contact with material
4. Make sure the work surface is free from nails, knots, and other foreign objects
5. Place the workpiece securely in a vise or other recommended clamping device. Holding the workpiece by hand is unstable and may lead to loss of control
6. After turning on the router, wait until it has reached full speed before starting the cut
7. Never start the tool when the bit is touching the workpiece. The bit may grab the workpiece and cause loss of control

8. For maximum control, hold the router firmly with both hands. The reaction torque of the motor can cause the tool to twist
9. Always feed the cut against the direction of rotation. Feeding the tool in the wrong direction causes the cutting edge of the bit to climb out of the workpiece and pull the tool toward the operator
10. Do not touch the bit immediately after use, it will be very hot
11. Be sure that the router motor has stopped completely before you lay the router down

7.2 Lathe: *Cylindrical Shaping*

The lathe is capable of creating very ornate, round shapes of varying size. Things commonly produced on lathes include railing spindles or posts, pedestal table posts, and wooden bowls or platters. Using the lathe requires a fair amount of training, so if you have something specific in mind, see the shop supervisor well in advance to set aside time for instruction.



SAFETY

1. Turn material by hand to check clearance before starting the machine
2. Hold turning tools securely on the tool rest
3. Use slower speeds until the piece is balanced
4. Make sure material is fastened securely in the chuck
5. Remove chuck key immediately after using it
6. Exercise caution with material that has cracks, splits, bark or knots
7. Never leave the lathe running unattended.
8. Keep tools sharp, never force dull tools to cut
9. Rough cut the workpiece as close as possible to the finished shape before installing it on the faceplate
10. Move the cutting tool into the workpiece slowly, and take light cuts when roughing
11. Remove the tool rest before sanding or polishing.

12. Clear the lathe bed of all objects (tools, scraps of wood, etc.) before turning the machine "ON"
13. Never loosen the tailstock spindle or the tailstock while the workpiece is turning

8.0 Surfacing

8.1 Jointer: *Jointing*

The first step in flattening rough or warped wood, the wood is passed over the head of the machine removing 1-2mm per pass. Several passes may be necessary to correct a severe warp in the material. The face of the material should be jointed first and then that face can put against the fence to ensure a degree corner. Using the jointer only on one edge may also be necessary for cutting the material on the table saw afterwards. The use of the jointer can be a complex operation, see the shop supervisor before using this machine.



SAFETY

1. Always keep hands well away from the cutter-head, never push on the end of the material by hand, use a push stick or a specialized hold down paddle instead
2. The depth of cut is kept at less than 1/8" or 3mm. Never adjust this setting
3. Have someone help you with larger pieces
4. Boards must be longer than 8" or 15cm
5. Material should be no thinner than 12mm (1/2")
6. Never attempt to process end grain (end of board)
7. Never reach down to free material that gets stuck on the out-feed bed while machine is on and operating.
8. Never operate the jointer without guards.
9. Use the left hand to hold down; use the right hand for pushing stock
10. Never use your thumb as a push stick
11. Walk with the board through the cut on long boards

- Exercise caution with material that has cracks, splits, bark or knots

8.2 Planer: Planing



The planer is used to smooth & reduce the thickness of solid wood boards. It is not used to flatten boards. The planer will accommodate boards up to 20" or 500mm in width and up to 6" or 150mm in thickness. Planing can be a complex operation; it is usually a good idea to see the Lab supervisor before using the equipment.

SAFETY

- Boards must be longer than 10" or 250mm
- Only 1-2mm of material should be removed per pass. This equates to a quarter turn of the depth control handle
- Keep hands well away from the opening of the planer, if material gets stuck, pull from the back of the machine or push with a scrap piece of wood
- Do not feed the workpiece into the out-feed end of the machine. The workpiece will be thrown out of the opposite side at high speeds
- Remove shavings with the power "OFF" to prevent serious injury

9.0 General Safety for Handheld Power Tools.

- Eye protection is required when using these tools
- Stay focused on the tool and the work being performed
- Keep work area clear of other tools and materials
- Use the right tool for the job. Seek help if you are unsure of tool operating procedures
- Keep hands and fingers clear of tools' blade or bit and cutting path
- Secure work to bench when using electric hand tools
- Do not over-reach with electric hand tools

- Make all adjustments on the tool with the power cord unplugged
- Do not carry plugged in tools with finger on power switch
- Use only grounded extension cords
- Always keep tool guards in place
- Let the tool do the work. Do not force tools into the material
- Unplug, clean and put away tools when finished
- 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

10.0 Safety Guidelines for Hand Tools



10.1 Drills:

- Stay focused on the tool and the work being performed
- Select the proper size and type of bit for the job. Make sure it is sharp and not damaged
- Do not use excessive force into hard material as the bit might break
- Keep hands and fingers clear of tools' bit
- If the speed can be varied, operate the drill at the correct speed, and do not lock the switch of a hand-held drill in the on position



10.2 Jig Saws:

- Avoid accidental starting. Be sure power switch is off before plugging in
- Unplug tool when you need to change the blade or adjust the shoe angle
- Do not start saw with material to be cut touching the saw blade
- Always be aware of where your fingers and power cord are in relation to the cutting blade
- Always use the proper blade for the task at hand. The wrong type blade may cause the blade to seize and shake the tool violently, or may break the blade
- Use clamps to minimize vibration of the workpiece

7. Be aware of sharp burrs on the cut edge on metal pieces
8. Start cutting when the blade is moving at full speed
9. Do not force the saw blade into tight curves too quickly. You can break the saw blade
10. Cut with adequate clearance for the blade below the cut line. If the tip of the blade strikes down on a solid surface, it will break
11. Do not attempt to reinsert the blade into the cut line while the saw is running
12. Never touch the blade or reciprocating parts of the saw while it is in motion. The tip of the saw may not be visible while the saw is running
13. Be aware that the blade will be very hot after finishing a cut



10.3 Circular Saw:

1. Stay focused on the tool and the work being performed
2. Do not clamp or wedge the guard in the open position
3. Keep your finger off the trigger when carrying the saw
4. Do not cut the power cord. Wait until the blade stops before laying down the saw.
5. When finished, unplug the saw and put back in its proper storage.
6. Do not force the tool through the material being cut
7. Do not reach underneath the workpiece while operating this saw
8. Adjust the cutting depth to the thickness of the workpiece
9. Check lower guard for proper closing before each use
10. Never hold piece being cut in your hands or across your body
11. Secure the workpiece to a stable platform
12. Beware of Kickback - a sudden reaction to a pinched, bound or misaligned saw blade, causing an uncontrolled saw to lift up and out of the workpiece toward the operator
13. Maintain a firm grip with both hands on the saw while cutting



10.4 Belt Sander:

1. Stay focused on the tool and the work being performed
2. The use of a dust mask is encouraged when using this tool
3. Use appropriate sandpaper belt for sander and for work to be performed ask attendant for assistance if you are not sure which belt to use
4. Be sure switch is "OFF" before plugging in
5. Always keep finger or exposed flesh away from sanding belt
6. Hold handles firmly before starting sander.
7. When pausing or stopping sanding operation allow the sander to come to a complete stop.
8. Sander should "float" on top of material. Do not bear down on sander or push sander into material



10.5 Angle Grinder:

1. Portable grinders and brushes are difficult to handle because of their size and weight
2. Extra care is needed to avoid injury and to protect the grinding wheel and brushes from damage
3. Hold it firmly with both hands. When finished, make sure that the grinder has completely stopped turning before you lay it down
4. Never operate grinders without protecting your eyes with safety glasses, goggles, or a face shield
5. If the material being worked on will produce a lot of dust or other particles, you should wear a dust mask
6. All adjustments are to be checked and secured before the power is turned on
7. Remove all wrenches and other tools from the machine before turning the power on
8. 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

10.6 Hand Tools



Chisels

1. Keep them sharp. A dull chisel is a dangerous chisel, as it will require more effort to push the chisel through the stock
2. 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
3. Always clamp the work securely in a vise or to the bench top
4. Never hold the work with one hand while chiseling with the other.
5. Always cut with the blade pointing away from your body and keep your hands behind the cutting edge
6. Do not use a wood chisel as a pry or a wedge
7. Do not use a wood chisel on metal
8. Do not use an all-steel chisel with a mushroomed face or a chipped edge



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



Wrenches

Wrenches are the cause of many cut and skinned knuckles. When possible, use the open palm of your hand to push on the wrench. When this is not possible, pull the wrench toward you. This may prevent the wrench from slipping to cut or skin your knuckles. 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. This forces the movable jaw onto the nut to reduce its tendency to slip. It also

prevents damage to the wrench.



Hammers:

Check the fit and condition of the handles. Keep handles tightly, wedged into the heads to prevent injury to you and others nearby. Replace cracked or splintered handles. Select the right size for the job, a light hammer bounces off the work. One that's too heavy is hard to control.

11.0 House Keeping

The WA janitorial staff and DFL staff do not clean the shop facility. Each user is responsible for cleaning up after using the tools and facility.

Each student is personally responsible for clean up and tool return.

Each machine and work area should be cleaned immediately after use.

The last person to use a machine is responsible for cleaning the machine and surrounding work area.

If following a class project deadline, the shop has not been properly cleaned, any further shop access for that class or any individual students in the class may be suspended until the house keeping has been addressed properly.

12.0 Fire

Fires are divided into three "classes". Any of these classes of fires could occur in the shop.

1. **Class A:** Fires with ordinary combustible materials, such as wood, rags, and rubbish.

2. **Class B:** Fires with flammable liquids, such as gasoline, oil, grease, paints & thinners.

3. **Class C:** Fires in or near electrical equipment such as motors, switchboards & electrical wiring.

For any fire to start or remain burning, it must have the following three things:

1. Fuel-Any combustible material.

2. Heat-Enough to raise the fuel to its ignition temp.

3. Oxygen-Necessary to sustain combustion

If any of the three is missing, a fire cannot be started. With the removal of any one, a fire will be extinguished.

Fire Alarm

If you hear the fire alarm:

1. Stop what you are doing
2. Shut off all machinery
3. Exit and go to the parking lot

WA staff will be acting as UW Fire Wardens and will instruct you to leave by the nearest exit and remain away from the building. When the shop is not supervised the Security guards assume the authority of warden. Wardens will be posted outside of the building to assist you in your exit and to ensure that no one returns to the building. Return to the building only if and when the wardens have given approval to re-enter.

Open flames are not permitted in the DFL or anywhere in the School. Any items associated with flame will be confiscated.

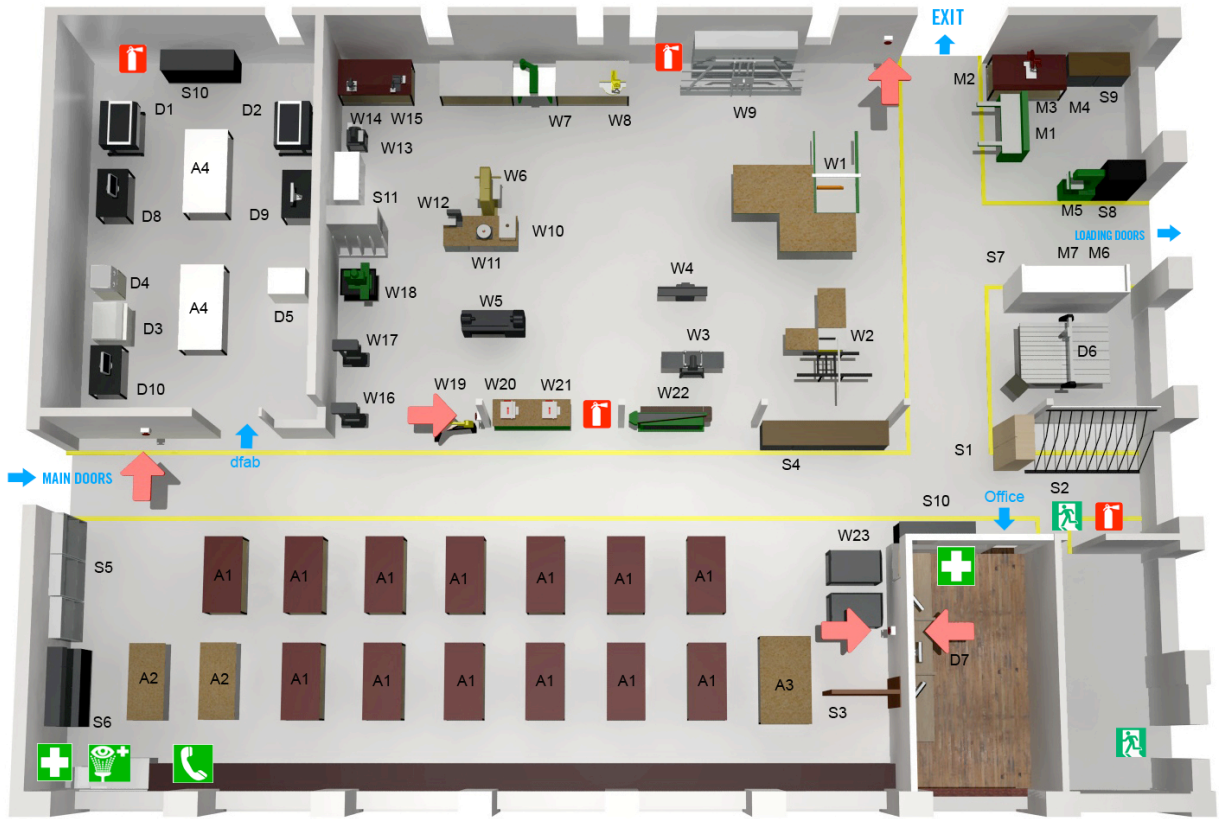
13.0 Demerit Point Offences

To help instill a safety first mindset, the DFL administers a demerit point system to help improve student behavior and protect against others who abuse the lab privileges. Lab users are responsible for understanding the **DFL User Guide** and following all the safety rules outlined in the **DFL Safety Policy**. The system is based on the accumulation of “points” per term. The critical point value is 5 and if any one individual receives a total of 5 demerit points in any given term- their DFL privileges will be suspended. In addition, if any individual receives infractions of the same offence 3 times, that individual will also have their DFL privileges suspended. A meeting will automatically occur upon an individual’s accumulation of 5 demerit points to review the infractions and communicate their status. The same will occur after 3 offences of the same infraction. Suspension will last the duration of the term. Once the term is completed the suspension is lifted and the individuals’ demerits are wiped clean. Any individual who has been suspended will need to take the safety tour and test before their DFL privileges are reinstated.

The following is a list of rules and there associated Demerit values:

1. Operating equipment under the influence of drugs or alcohol 5
2. Freehand cutting material on any table saw 5
3. Ignoring specific instructions from a shop technician 3
4. Improper use of the table saw fences
Cross cutting material on a table saw with the rip fence and ripping material using a cross-cut set up are considered improper use 2
5. Use of open flame in the DFL 2
6. Disabling a safety guard on machine 2
7. Use of prohibited personal power tools
The DFL only assumes responsibility with equipment supplied by and maintained by the WA DFL. The only power tools permitted afterhours include; hand drills, dremels and sanders. 2
8. Not using safety glasses in the machine tool zone 1
9. Allowing scrap and debris to build up around equipment and work areas
10. Improper LAB attire
Wearing loose jewelry or clothes and ear phones in machine tool zone will be considered inappropriate attire as well as not containing or controlling long hair 1
11. No push stick when feeding material close to blade
On the General and DeWalt table saws anything less than 12” between the blade and the fence requires a push stick. On the small “Ken & Barbie” saws a 3” distance between the fence and blade will be accepted 1
12. Unauthorized use of materials or supplies 1
13. Unauthorized Removal of Lab tools or equipment: 1
14. Instigating or participating in Horseplay in the Labs 1
15. Improper use or abuse of the DFL facilities: 1
Improper use and abuse will be defined as:
 - Spray glue or paint overspray on tables & equipment
 - X-acto knife cutting on machine and tool surfaces
 - Concrete, paint, wax and plaster in the sink
 - Painting on tables / equipment without protective sheets
 - Damaging tools or equipment

WATERLOO ARCHITECTURE | FABRICATION LABS



WOOD WORKING

- W1 14" Table saw
- W2 10" Table saw
- W3 13 Planer
- W4 6" Jointer
- W5 12" Wood Lathe
- W6 20" Bandsaw
- W7 14: Radial Arm Saw
- W8 Compound Miter Saw
- W9 Panel Saw
- W10 Router table
- W11 Spindle sander
- W12 10" Bandsaw
- W13 6" Belt/disc sander
- W14 Mortiser
- W15 1"belt/disc sander
- W16 16"Drill press
- W17 16"Drill pess
- W18 Drill/mill machine
- W19 Scroll saw

WOODWORKING

- W20 4" Table saw
- W21 4" Table saw
- W22 Edge sander
- W23 Down draft table(2)
- M1 52" foot shear
- M2 Bench grinder
- M3 Cut-off saw
- M4 12" Disc sander
- M5 15" Bandsaw
- M6 24" Brake
- M7 Notcher

ASSEMBLY

- A1 30"X72" Work bench
- A2 34"X72" finishing bench
- A3 36"X84" assembly table
- A4 36"X84" assembly table

STORAGE

- S1 Wood hand tools
- S2 Materials storage
- S3 Clamp Rack
- S4 Tool Cabinets
- S5 Student Tool Cabinet
- S6 Paint/flammables
- S7 Metal misc.storage
- S8 Tool cabinet
- S9 Metalwork tools
- S10 Power tool cabinet
- S11 Scraps materials

DIGITAL FABRICATION

- D1 100W Laser cutter
- D2 50W Laser cutter
- D3 ZCorp 3D Printer
- D4 Depowdering unit
- D5 FDM 2000 3D printer
- D6 CNC Router
- D7 CAM Workstation
- D8 Laser Workstation
- D9 Laser workstation
- D10 3D print workstation

EMERGENCY SERVICES

- First aid
- Emergency shut-off
- Emergency exit
- Fire extinguisher
- Eye-wash station
- Telephone

