W.L. Hall Workshop Overview

The W. L. Hall Workshop provides equipment, facilities, staff and instruction to College of Design students for the execution and enrichment of their educational experience. The Workshop provides a full complement of power and hand tools for the manipulation of wood and related media: a limited selection of equipment for the working of metals and other materials is also available. Workshop staff provide user assistance, training and supervision while offering users an extensive knowledge of materials, tools, processes and safety. Instructors of courses which will utilize the Workshop are encouraged to contact Workshop staff to arrange for an introduction to Workshop capabilities and procedures. Unsafe use of Workshop facilities or equipment may result in revocation of access to the facility.

Other roles of the Workshop and its staff include: support of faculty and staff in the design and construction of furnishings, liaison to Environmental Health and Safety and Facilities Management and support of CDES staff in University functions.

General Operating Hours

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Contact Information

Office Phone 612.624.9093
WWW http://design.umn.edu/current_students/leo/hall/index.html
E-mail archshop@umn.edu
Address W.L. Hall Workshop
139 Rapson Hall
89 Church St. SE
Minneapolis, MN 55455
Policies and Procedures

Shop Access Privileges
• ALL shop users MUST be registered CDES students who have:
  paid the Collegiate Fee for the current semester.
  or:
  Faculty or Staff.
  and:
  have legitimate CDES course related work.
• Shop Access Privileges can be revoked at any time at the discretion of Workshop personnel.
• Revocation of Shop Access Privileges must be reconciled with the Shop Manager.
• Sign in EVERY time you use the shop.

Shop Hours
• Shop hours are established each semester. Hours are posted in the shop, on the webpage and on the shop voicemail.
• Any extension of scheduled operating hours MUST be approved by shop management.
• Extension of shop hours must be requested by instructors at least 48 hours prior to the hours in question.

the Annex
• rm 135 (the Annex) is available for 24 hr access to students who have paid the Collegiate Fee.
• If the Annex is not CLEAN at 8:00am, it may be CLOSED for the next 24 hours.
• If the Annex door is found propped open AT ANY TIME, the Annex may be closed INDEFINITELY.
• If your U-Card does not open the Annex door, please let us know so that we can resolve the issue.

Personal Protective Equipment
• Safety glasses or goggles MUST be worn during the operation of any stationary or portable power equipment (non-tinted, plastic-lens prescription glasses are also acceptable).
• Ear muffs and ear plugs are available and should be worn during sustained use of noise generating equipment.
• Dust masks are available and should be worn when generating significant dust.

Housekeeping
• A clean shop is an effective shop. Be considerate of other shop users by keeping your work area neat.
• ANY materials sitting on the floor at ANY time will be considered trash and treated accordingly.
• Sweep up any significant dust or refuse as you make it. Throw away scraps as you make them.
• Daily clean-up starts ten minutes before closing. Please help us clean up by stopping work, returning tools and removing/storing your materials at least ten minutes before closing time.

Materials Storage
• Store any materials neatly and out of the way of other shop users.
• Obtain permission from a Shop Technician before leaving any materials unattended in the shop.
• Clearly mark any materials with name, date and contact information.
• Unidentified materials may be disposed of at the Shop Technician’s discretion.
• Identified materials may be disposed of if left in the shop for over one week.
Policies and Procedures

Tool Check-Out
- You are responsible for any tools you check out. If Workshop equipment is lost, stolen or damaged while checked out to you, you are responsible for replacement.
- Obtain approval from Shop Technician before removing ANY tool from the shop.
- Obtain special permission for periods longer than 2 hours.
- Tools should be returned to the shop promptly upon completion of use.
- Tools checked out overnight should be removed less than 1 hour before closing.
- Tools checked out overnight must be returned within one hour of opening the next day.
- Tool Check-Out privileges can be revoked at any time at the Shop Technician’s discretion.
- A $1 per day, per tool late fee may be imposed.

Materials Sales
- The Workshop provides miscellaneous materials, tooling and hardware for sale to shop users.
- Materials must be charged to your student account before they are used.
- Check on inventory of materials prior to needed date, stock can be inconsistent.
- With adequate notice, we may be able to order specific materials for you, check with shop management.

Air Quality and Dust Collection
- In order to maintain the air quality in the shop and neighboring areas an extensive dust collection system is provided.
- NEVER allow sparks or other incendiary material to enter the dust collection system.
- Sawdust is a known carcinogen; collectively the shop staff is in the shop over 120 hrs/wk: please help to minimize our exposure to this and other toxic substances.
- The generation of harmful fumes outside of properly ventilated areas is against Federal law.
- Please use finishes adhesives, resins and similar products in the spray booth ONLY!!

Non-Academic Projects
- The University’s Office of Risk Management has determined that use of the W.L. Hall Workshop for non-academic purposes exposes the University to unnecessary risk and does not serve the mission of the University or the College of Design. All shop use must be directly related to CDES (or University) courses or activities.
Workshop Occupancy Policy

In order to maintain an acceptable level of user safety, the Workshop has adopted the following occupancy limits. This policy takes into account space, equipment and staff limitations of the Workshop.

Occupancy of rm 139 may be limited to 20 users per shop technician.

The primary responsibility of Shop Technicians is monitoring the safety of shop users. The number of users which an individual Shop Technician is able to effectively monitor is affected by many factors. It shall be each Shop Technician’s responsibility to determine how many users they can effectively monitor under any given circumstances. Generally, each Shop Technician should be able to monitor 20-25 users. This limit may be adjusted upward or downward at the Shop Technician/s discretion dependent upon conditions.

A maximum of 50 students will be allowed in rm 139 at any given time.

The nature of the work conducted in the Workshop requires significant space for each machine and user. Each machine requires a clear space for safe operation. Traffic ways must be kept clear for the safe movement of people and materials. For typical utilization of shop equipment and furnishings, 50 users has been deemed to be the maximum safe occupancy capacity. This limit may be adjusted upward or downward at the Shop Technician/s discretion dependent upon conditions.

If occupancy limits are exceeded:
- The most recent arrivals will be asked to retire to rm 135 (the Annex).
- The Workshop door will be locked.
- Shop users will be asked to wait in the Annex, and establish a queue amongst themselves.
- As users leave rm 139 or machines become available, shop technicians will admit users from the Annex.

If a safe environment cannot be established through the application of the procedure above, the Workshop may be CLOSED to establish order at the discretion of the Shop Technician/s on duty.

Application of this policy will be left to the discretion of Shop Technician/s on duty.

Resolution of any disputes regarding the application of this policy shall be the responsibility of the Workshop Manager in conjunction with the Chief of Staff and/or Associate Dean of Academic Affairs.

Please consider these occupancy limits when assigning projects and deadlines.

Notify Workshop management of expected heavy shop use so that adequate staff can be scheduled.

If Workshop occupancy is expected to exceed 40 users as a result of your class, you should make arrangements for additional Shop Technicians to be scheduled at least 1 week prior to the day of expected shop use.
Workshop Policy on Special Projects

The primary mission of the Workshop and its staff is to serve the needs of CDES students in their academic work. At the same time, the Workshop receives many requests to work on projects for units within the College of Architecture and Landscape Architecture. Since the Workshop’s primary responsibility is to CDES students and because they receive many requests for special projects, this policy on handling special projects is warranted.

Each special project has two costs: The cost of materials and the cost of staff time.

Cost of Materials
Each unit requesting a special project needs to provide the Workshop manager with an account number to use for purchase of materials. Actual cost of materials used in the completion of a project will be charged to the requesting unit.

Cost of Staff Time
Depending on the urgency of the project, Shop Technicians may work additional hours in order to make staff available to work on the project. If this is the case, hours will be billed to the unit requesting the project. If any Workshop personnel work overtime to complete the project, the requesting unit is responsible for their overtime pay.

If a project can be completed during the normal shop schedule, the unit will not be charged for staff time. Projects completed during the normal shop schedule are subject to all other demands on the Workshop and staff. During a typical week there may be only a few hours in which shop staff are able to work on special projects.

Priority
The priority of working on special projects depends on the urgency, difficulty and scope of the project. If a unit is willing to pay for staff time, a project may be expedited by making additional shop staff available to work on the project. If the unit is not willing to pay for staff time, the Workshop manager will add the project to a list of projects. Many factors such as urgency, difficulty, time and space requirements, etc, will be considered in determining the priority of these projects. The Workshop can make no guarantee as to completion dates on ANY special projects. If the Workshop is being used by students, work on special projects will not be done if it would interfere with student shop use.

Within units, the unit head will prioritize projects. Across units, the Administrative Council will prioritize projects. The Workshop manager will provide advice to these groups on difficulty, scope, and time and space requirements of projects.

Extra-Collegiate Projects
The Workshop will not work on projects for units outside of CDES without first discussing with the Chief of Staff and/or Associate Dean of Academic Affairs.
Materials Usage Guidelines

W.L. Hall Workshop personnel have the challenging task of providing the CDES student body with a safe, efficient and cost effective work environment. Certain materials, processes and/or practices have a detrimental effect on the Workshop’s ability to provide one or more of the above elements. These Materials Use Guidelines are intended minimize the potential of the Workshop’s capacities being overwhelmed by particular materials, processes and/or practices. Please consider these guidelines when developing assignments. Feel free to contact workshop management if you have any questions about these guidelines or other workshop related issues.

Sheet Stock- Sheet stock should be employed only in the thicknesses in which it is commercially available. The widespread practice of planning or thickness sanding of sheet materials will not be allowed.

Shaping/Modeling- Shaping of rectilinear objects into organic forms through sanding should be kept to a minimum. Such activities are the root cause of the majority of shop accidents and overwhelm our dust collection system. Additive processes rather than reductive processes should be explored when developing assignments involving organic forms. We have no mechanism for the containment of dust generated by significant contouring of site models or other organic forms. Students conducting such modeling will only be allowed to do it outside the building.

Plaster/HydroCal – Unless it is absolutely dry, the manipulation of cast plaster/hydrocal elements in the workshop is not allowed. Dry plaster may be machined only with the permission of shop staff.

Toxic Materials – The employment of toxic materials must be kept to a bare minimum. Please review the Material Safety Data Sheet for any material before assigning its use.

Welding – We have the capacity for welding only raw steel and aluminum. Welding of stainless steel, galvanized steel, finished and exotic metals generate toxic gases which we do not have the necessary ventilation to safely weld.

Spray Booth – The spray booth in rm 135 Rapson is the only approved location to use substances which generate harmful vapors. Never use spray adhesive, spray paint, solvents or other volatile materials anywhere but the spray booth.

Material Safety Data Sheets (MSDS) – MSDSs provide information about the health hazards that may be associated with manufactured products as well as recommendations for limiting exposures and treating potential exposures. CDES will, in rm 139 Rapson Hall, maintain a library of MSDSs of materials used in environs.
Consult with a Shop Technician before performing any procedure you are unfamiliar with. He or she is the one to decide if the work can and should be done, and will be able to suggest the safest, most efficient way to do it.

Think of the Workshop as an applied physics lab. For every action, there is an equal and opposite reaction. Be prepared for all of the possible reactions to your action.

**Clothing:** Dress properly for your work. Remove coats and jackets, roll up loose sleeves, remove loose jewelry and tie back long hair. Wear shoes, **NO SANDLES ALLOWED!**

**Eye Protection:** Wear safety glasses, goggles or a face shield when operating any power tools. Be sure you have enough good light to see what you are doing.

**Headphones:** When operating machines, you need to be able to hear what’s going on around you. Headphones are prohibited when operating power tools.

**NEVER** use the shop if you are under the influence of alcohol or drugs.

Sleep deprivation impairs judgment: despite what your instructor might tell you, your project IS NOT more important than your fingers. Know when to call it a night.

Be thoughtful and helpful toward other shop users. Be sure the work you're doing doesn't endanger yourself or anybody else. Caution other students if they are not following safe operating procedures.

Select the proper size and type of tool for your work. Never use a tool unless it is sharp and in good condition. Inform a Shop Technician if tools are damaged, dull or in need of adjustment.

**Carrying Tools:** Keep sharp-edged and pointed tools turned down. Do not swing or raise your arms over your head while carrying tools. Do not carry sharp tools in the pockets of your clothes.

**Clamping Stock:** Whenever possible, mount the work in a vise, clamp or special holder. This is especially important when using chisels, gouges, portable electric tools, or drill press.

**Working Speed:** Give yourself enough time to complete your work. Rushing can lead to accidents and seldom produces quality work.

**Floor safety:** The floor should be clear of scrap blocks and excessive litter. Keep projects, saw horses and other equipment and materials you are using out of traffic lanes. Immediately wipe up any liquids spilled on the floor.

**Injuries:** Report any injury, however minor, to a Shop Technician.
Portable Power Tool Safety

Wear appropriate personal protective equipment. (safety glasses, ear plugs, dust masks, etc.)

Use the Workshop as an Applied Physics Lab. For every action, there is an equal and opposite reaction. Be prepared for all of the possible reactions to your action.

Never attempt to use a tool that you are unfamiliar with. Seek the assistance of a Shop Technician if you have any questions about the safe operation of any tool.

Think through an operation before performing it. Know what you are going to do and what the machine will do in response.

Make all the necessary adjustments before turning a tool on.

Never remove or adjust a safety guard on any machine or tool without permission.

You must be wide awake and alert. Never operate a power tool when you are tired.

Allow the tool to reach its full operating speed before feeding it into your stock.

Work the tool carefully and only as fast as the material will be cut easily.

Most cutting tools should work without the use of excessive force. If a tool does not cut cleanly and easily, it is probably dull or damaged. Please bring it to the Shop Technician's attention.

If a tool is not working properly, shut off the power immediately and inform a Shop Technician.

Do not allow your attention to be distracted while using a tool. Do not distract other shop users while they are using power tools.

When you're done using the shop, put away all tools, clean up your workspace and sign out.
Stationary Power Tool Safety

Never operate a machine or power tool without the approval and/or instruction of a Shop Technician.

Tell us what you want to do and we will suggest the safest, most efficient way to get it done.

Use the Workshop as an Applied Physics Lab. For every action, there is an equal and opposite reaction. Be prepared for all of the possible reactions to your action.

Think through an operation before performing it. Know what you are going to do and what the machine will do in response.

Make all the necessary adjustments before turning on the machine. Adjustments on certain machines will require approval.

Never remove or adjust a safety guard on any machine or tool without permission.

Use approved push sticks, feather boards and safety devices. Some operations require the use of a special jig or fixture.

You must be wide awake and alert. Never operate a machine when you are tired or impaired.

Keep the machine tables and working surfaces clear of tools, stock and project materials. Also keep the floor free of scraps and excessive litter.

Allow the machine to reach its full operating speed before feeding in the work.

Feed the work carefully and only as fast as the machine will easily cut it.

Most cutting tools should work without the use of excessive force. If a tool does not cut cleanly and easily, it is probably dull or damaged. Please bring it to the Shop Technician’s attention.

If a machine is not working properly, shut off the power immediately and inform a Shop Technician.

When you are operating the machine, you are the only one to control it. If someone is helping you, be sure they understand what you are doing and what they will be doing.

Do not allow your attention to be distracted while operating a machine. Do not distract other shop users while they are operating equipment.

When you have completed an operation on a machine, shut off the power. Wait until it stops before leaving the machine or setting up another cut.

When you’re done using the shop, put away all tools, clean up your workspace and sign out.
Woodworking Equipment

Band Saw

YOUR STOCK MUST SIT FLAT ON THE TABLE OR BE SECURELY CLAMPED TO SOMETHING SITTING FLAT ON THE TABLE!

Wheel guard doors must be closed and the blade properly adjusted before turning on the machine.

Adjust the upper guide assembly so it is ¼ inch above the work.

Check blade guides for proper set-up.

Allow the saw to reach full speed before feeding the work.

Use appropriate fence and/or guide. The stock **MUST** be held flat on the table.

Feed your stock only as fast as the teeth will easily remove the wood.

Whenever possible, plan saw cuts to avoid backing out of curves.

Make turns carefully and do not cut radii so small that the blade is twisted.

**STOP** the machine before backing out of a long curved cut.

Round stock should be mounted securely in a jig or hand screw.

If a blade breaks: step away from the saw, shut off the machine and wait for the machine to come to a complete stop. Have a Shop Technician install a new blade.

Turn off the machine as soon as you have finished your work. Do not leave the machine until it has stopped running.

Consider the size of your stock/work when picking a machine. Use small machines for small cuts and large machines for large cuts.

2) 9” bandsaws and small belt/disc sanders are available for use in the annex.
Belt/Disc Sander

YOUR STOCK MUST SIT FLAT ON THE TABLE OR BE SECURELY CLAMPED TO SOMETHING SITTING FLAT ON THE TABLE!

Be certain the belt or disk is correctly mounted. The belt must track in the center of the drums and platen. Do not operate the disk sander if the abrasive paper is loose.

Check the guards and table adjustments to see that they are in the correct position and securely locked in place.

Whenever possible, use the table, fence and other guides to control the position of the work.

Small and irregularly shaped pieces should be held in a hand clamp, special jig, or fixture.

Sand only on the side of the disk sander that is moving down toward the table.

Move your work-piece as you sand so that it doesn’t burn or clog the abrasive.

Always use a backing block or other technique when sanding thin pieces on the belt sander.

Do not use power sanders to form and shape parts if the operations could be better performed on other machines.

Sand only clean, new wood.

Do not sand work that has excess glue or finish on the surface. These materials will load and foul the abrasive.

Consider the size of your stock/work when picking a machine. Use small machines for small cuts and large machines for large cuts.

2) 9" bandsaws and small belt/disc sanders are available for use in the Annex.
Work-piece **MUST** sit flat on the table and firmly against the stop/miter gauge.

Be certain the belt is correctly mounted. The belt must track in the center of the drums and platen.

Check the guards and table adjustments to see that they are in the correct position and securely locked in place.

Small and irregularly shaped pieces should be held in a hand clamp, special jig, or fixture.

Move your work-piece as you sand so that it doesn’t burn or clog the abrasive.

Always use a backer block or other technique when sanding thin pieces on the belt sander.

Do not use power sanders to form and shape parts if the operations could be better performed on other machines.

Sand only clean, new wood.

Do not sand work that has wet glue or finish on the surface. These materials will load and foul the abrasive.
Wide Drum Sander

This machine is used to thickness wood composite materials (Homasote, MDF, Particle Board) and to finish sand solid wood materials.

Never thickness more than 4 sq/ft of material without the permission of a shop technician!

This machine is usually fitted with a very coarse abrasive intended to thickness sand wood composites, if you need to finish sand something please ask a shop technician for assistance in changing the abrasive.

Single workpieces must be at least 10” long,

Shorter workpieces may be sanded by feeding them end to end.

Turn hand wheel to adjust the conveyor table height to the thickness of your stock. (thickness indicator on right side of conveyor table)

Adjust the conveyor feed to the desired speed with adjustment dial.

Turn on the drum with the toggle switch.

Push your workpiece beneath the drum head.

This machine is not designed for removing more than 1/32” per pass. Never adjust the handwheel more than ½-turn per pass - damage to the machine will result!!

Shut off both switches before stepping away from the machine.
**Oscillating Spindle Sander**

Select desired drum diameter and abrasive grit.

Remove drum retaining bolt by turning CLOCKWISE.

Confirm that there are washers on both ends of the sanding drum.

Install new drum/abrasive and tighten retaining bolt by turning COUNTERCLOCKWISE.

Insert throat plat with appropriate opening.

Hold workpiece FIRMLY while pressing against rotating spindle.

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**Scroll Saw**

De-tension blade before changing.

Pass blade through hole drilled in stock for blind cuts.

Install blade in a vertical position with the teeth pointing down.

Tighten blade clamping bolts firmly to prevent blade slippage.

Apply sufficient tension to blade AFTER clamping, by rotating the blade tensioning lever.

Maximum cutting thickness is 1", excessive thickness will cause the blade to break.

Rotate material to adjust track rather than pushing into the side of the blade,

DO NOT push stock into the side of the blade.
Drill Press

Use the right bit and drill speed for the job. Holes over 1/2 inch and in harder materials should be bored at the lower speeds. Check with the Shop Technician if you’re unsure of proper speed.

UNLOCK table before adjusting height.

Mount the bit securely in the drill chuck.

Position the table and adjust the feed stroke so there is no possibility of the bit striking the table.

Use a backing board to protect the table and to drill cleaner holes.

Use a punch to locate holes in hard materials to prevent drill bit from skating.

Small or irregularly shaped pieces must be clamped to the table or held firmly by some means.

Feed the bit smoothly into the work.

When the hole is deep, withdraw it frequently to clear the shavings and cool the bit.

Hold stock with vice or other fixture to prevent injury caused by spinning stock.

Use only an approved bit. Bits with feed screws or those that have excessive length generally should not be used in a drill press.
Hollow Chisel Mortiser

See a Shop Technician for assistance with installation of chisel/bit set.
Select and install desired chisel/bit set.
Set fence, hold down and depth stop to desired positions.
Place scrap backing board beneath stock if through cutting.
Make cut with steady even pressure and speed
Retract chisel from cut.
If machine clogs with chips, shut off immediately and see a Shop Technician for assistance in clearing the machine.
Remove all scraps and clean up area when completed.
Miter Saw

Hold stock firmly against back fence of saw.

Keep hands clear of cutting area.

Set desired cutting angles and lock adjustment mechanism.

DO NOT cut any workpiece that is not firmly anchored against back fence.

Use appropriately sized stock.

NEVER interfere with the operation of retractable blade guard.

NEVER force the tool. If the saw doesn't cut properly ask a Shop Technician for help.

Use the appropriate blade. If you are cutting non-wood materials, make sure the blade is appropriate for the job.

Beware of flying off-cuts. This saw tends to fling small off-cuts. Use supplemental back fence, clamp workpiece or construct a holder to save small off-cuts.

When using the sliding feature on the sliding compound miter saw, pull the saw toward before lowering the blade into the stock.
Surface Planer

NEVER run used wood through this machine: only NEW SOLID WOOD can be used.

Get approval of Shop Technician before operating.

Allow machine to feed stock.

NEVER push or pull material through machine.

If stock binds or stops, adjust depth to allow completion of the cutting pass.

Shut off the machine if stock fails to feed all the way through.

NEVER look or reach into the mouth of the machine while it's running.

Plane only with the grain of the wood.

The maximum depth of cut per pass should not exceed 1/16th inch.

The stock MUST be at least 12 inches long.

Keep hands away from the cutterhead.

The old surface planer may be used to thickness composite materials such as: Homasote, MDF and particle board.
**Router Table**

Have a Shop Technician check your set-up before using machine.

Select router bit and install in appropriate router collet. DO NOT "bottom out" the router bit: install bit with >90% of shaft in collet.

Cut only new stock that is straight and true, and free of splits, checks and knots.

Consider the direction of cut. Stock is almost always moved from right to left.

Use caution to avoid “self-feeding” cuts. Such cuts can rapidly throw stock from the operator.

Make numerous shallow passes rather than one deep pass. Excessive depth of cut is dangerous, and damages tooling and equipment.

Use the fence for all straight line cuts. Be certain it is properly adjusted and securely locked in place.

Use guards, feather boards and hold-down devices whenever possible.

Use appropriately sized stock. Small profiles should be milled out of lengths of stock. A jig or fixture may be necessary for milling small pieces.

Make a trial cut on an extra piece of stock that is the same thickness as your project work.
**Jointer**

Get a Shop Technician's approval before operating the jointer.

NEVER run used wood through this machine; only **NEW, SOLID** wood can be used.

Use push sticks or push blocks to handle the stock.

Inspect stock carefully for staples, nails etc. Any foreign matter will damage the knives.

Make adjustments for depth of cut and position of fence before turning on the machine.

Recommended depth of cut for jointing an edge is 1/8 inch; for a flat surface, 1/16 inch.

Stock must be at least 12 inches long. Stock to be surfaced must be at least 3/8 inch thick.

Feed the work so the knives will cut with the grain.

NEVER attempt to joint end grain.

Use only new stock that is free of knots, splits and checks.

Keep your hands away from the cutterhead even though the guard is in position. Maintain at least a 4 inch margin of safety.

The jointer knives must be sharp: dull knives will vibrate the stock and may cause a kickback.
Get the approval of a Shop Technician before using this machine.

Mount workpiece firmly between centers, on faceplate or in chuck before turning on machine.

Select appropriate speed before plugging in the machine.

Adjust tool rest to minimal distance from workpiece.

Rotate stock manually before applying power to guarantee proper mounting and toolrest clearance.

Select appropriate turning tool for the task at hand.

ALWAYS hold turning tool firmly with both hands.

ALWAYS tilt turning tool down onto rotating workpiece.

Consider the grain of the stock when removing material, work the cutting tool with the grain for the best results.
More shop related injuries occur on tablesaws than any other woodworking machines.

The **KEY** to tablesaw safety is moving the material past the blade in a **STRAIGHT LINE** and avoiding trapping cut off pieces between the blade and other parts of the saw.

**ALWAYS HAVE THE LONGEST EDGE OF THE STOCK THAT YOU ARE CUTTING AGAINST THE DEVICE THAT YOU ARE USING TO MAKE IT GO STRAIGHT!!**

**RIPPING**
When your workpiece is longer than it is wide, guide it along the rip fence.

Be certain to keep the edge flat against the rip fence for the entire length of the cut.

**NEVER** push on the "waste" side of your stock, or push the off-cut "waste" piece into the blade.

Use the blade guard whenever possible

Use a push block if the blade guard must be moved out of your way

**CROSSCUTTING**
When your workpiece is wider than it is long, use a miter gauge, crosscut fence or other jig to guide your workpiece.

Push your workpiece all the way past the blade.

**DO NOT** push on or handle the "waste" or off-cut piece until the saw has come to a complete stop.

**NEVER** use the rip fence as a stop when cross cutting!
Tablesaw (cont).

**NEVER, NEVER, EVER, EVER** attempt to cut stock freehand!!

When the blade guard is in place, use your hands to guide your workpiece. If the blade guard physically inhibits a cut, move the blade guard out of your way and use a push stick to guide your workpiece.

**NEVER** allow an off cut or "waste" piece to become pinched between the blade and the rip fence.

The SawStop mechanism is triggered when conductive materials are contacted by the saw blade. If you have any suspicion that the material you are cutting may conduct electricity, check with a Shop Technician to test the material before attempting to cut the material.

Be certain the blade is sharp and the right one for your work.

Use all appropriate guards, splitters and safety mechanisms.

Set the blade so it extends about 1/4 inch above the stock to be cut.

Stand to either side of the operating blade and the stock to be cut, not directly behind the workpiece.

Maintain a 4 inch margin of safety. Do not let your hands come closer than 4 inches to the spinning blade even when the guard is in position.

Stock must have at least one straight edge before being cut on the tablesaw.

The position of the stock must be controlled either by the fence or the miter gauge.

Use only new stock that is free of knots, splits and warp.

Stop the saw before making adjustments to the fence or blade.

Do not let small scrap cuttings accumulate around the saw blade. Shut off the machine, let blade stop and remove.

Resawing and other special setups MUST be inspected by a Shop Technician before power is turned on.

The dado or any special blades should be removed from the saw after use.

Users helping with "out feed" of materials should not push or pull the stock but only support it. The operator must control the feed and direction of the cut at all times.

When you complete your work, turn off the machine and remain until the blade has stopped.

Return any removed guards. Clear the saw table and throw away your scraps.
**Metalworking Equipment**

**Sheet Metal Shear**

This machine is used to shear (cut) mild steel, copper, brass, aluminum and other sheet metals.

**CAPACITIES:**
- mild steel, 16ga 0.0625"
- aluminum, 12ga 0.0875"
- stainless steel, 20ga 0.0375"
- plastics, 3/32" 0.09375"

NEVER exceed material thickness capacities. NEVER use shear to cut rod, bar, tube or cable stock. Keep fingers clear of shear blade. Remove waste material when completed with your work.

**Sheet Metal Shear/Brake/Roll**

This machine is used to cut, bend and roll (coil) sheet metal and other sheet materials. Get the approval of a Shop Technician before using this machine.

**CAPACITIES:**
- mild steel, 20ga 0.0375"
- aluminum, 16ga 0.0625"
- stainless steel, 22ga 0.0312"
- plastics, 3/32" 0.09375"

NEVER exceed material thickness capacities. NEVER use shear to cut rod, bar, tube or cable stock. Keep fingers clear of shear blade. Remove waste material when completed with your work.
**Sheet Metal Brake**

Use this Machine to bend sheet metal up to 1/8” thick.

Adjust the bending die for the thickness of your stock.

Clamp your stock into the mouth of the brake.

Lift the brake die to fold your material

See a Shop Technician if you need assistance installing/removing the fingers for box bending

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**Horizontal Band Saw**

This machine is used to cut metal tube, rod, bar and other shapes.

Raise the cutting arm enough to clear the workpiece.

Lock the cutting head by closing valve on hydraulic cylinder.

Adjust vise angle to desired position.

Set workpiece FLAT on saw bed.

Clamp workpiece firmly in vise.

Turn on saw (the coolant pump comes on automatically).

Unlock the cutting head by opening valve on hydraulic cylinder.

Adjust feed speed by turning dial on hydraulic cylinder.

Do not attempt to cut metal too fast, it damages the blades.
**Vertical Band Saw**

The vertical band saw in the metal shop is adjustable speed, check with a shop technician before cutting to confirm the speed is appropriate for the material you are cutting.

**YOUR STOCK MUST SIT FLAT ON THE TABLE OR BE SECURELY CLAMPED TO SOMETHING SITTING FLAT ON THE TABLE!**

Wheel guard doors must be closed and the blade properly adjusted before turning on the machine.

Adjust the upper guide assembly so it is ¼ inch above the work.

Check blade guides for proper set-up.

Allow the saw to reach full speed before feeding the work.

Use appropriate fence and/or guide. The stock **MUST** be held flat on the table.

Feed your stock only as fast as the teeth will easily remove the wood.

Whenever possible plan saw cuts to avoid backing out of curves.

Make turns carefully and do not cut radii so small that the blade is twisted.

**STOP** the machine before backing out of a long curved cut.

Round stock should be mounted securely in a jig or hand screw.

If the blade breaks: step away from the saw, shut off the machine and wait for the machine to come to a complete stop. Have a Shop Technician install a new blade.

Turn off the machine as soon as you have finished your work. Do not leave the machine until it has stopped running.
MIG Welding
(Metal Inert Gas)
AKA: Wire Feed Welding

MIG welding is the simplest way for a beginner to produce quality welds in mild steel.

See a technician to schedule a demonstration before attempting any welding.

Use only raw mild steel. (Galvanized) steel and steel coated with paint and other products may off-gas toxic fumes while welding.

Always ground the workpiece or table.

Always don a welding hood prior striking any arc.

Turn on shielding gas.

Adjust voltage and wire feed speed as appropriate for the material and workpiece thickness.

ALWAYS close shielding gas tank when you're done welding.

TIG Welding
(Tungsten Inert Gas)
AKA: HeliArc Welding

TIG Welding is an advanced welding process that can produce the best welds in a variety of materials (mild steel, tool steel, stainless steel, aluminum, titanium, etc)

Schedule an Orientation with Kevin before attempting any TIG welding.

Always ground the workpiece or table.

Always don a welding hood prior striking any arc.

Turn on shielding gas.

Adjust controls for the material and thickness of workpieces.

Select proper electrode for the job.

ALWAYS close shielding gas tank when you’re done welding.
using the LASER cutting system

LASER = Light Amplification by Stimulated Emission of Radiation

- there is a fee of $.50/min (actual cutting time) to use the laser
- non-CDES units will be charged $1.00/min
- cutting time is recorded by the machine as it cuts
- the laser may be used for ACADEMIC WORK ONLY!
- reserve laser time on the schedule on the laser room door
- each student is allowed to schedule a maximum of 1 hour per day, 3 hours/week
- if you are not at the laser at the start of your scheduled time and somebody else is, you forfeit that time
- we reserve the right to charge users for forfeited laser cutting time.
- non-scheduled laser use is first come/first serve
- clean up after yourself, there is a vacuum under the laser to suck up scraps
- NEVER operate the laser without using the EXHAUST FAN!!
- NEVER cut an "unknown" material, damage to the laser and/or toxic emissions may occur.

USE THESE COLORS/LINEWEIGHTS FOR AUTOCAD DOCUMENTS
BLACK RASTER ENGRAVE GREYSCALE and LINEWEIGHT > .0010
RED VECTOR ENGRAVING - SHALLOW LINEWEIGHT .0000
GREEN VECTOR ENGRAVING - DEEP LINEWEIGHT .0000
YELLOW VECTOR CUTTING - INTERIOR CUTS LINEWEIGHT .0000
BLUE VECTOR CUTTING - EXTERIOR CUTS LINEWEIGHT .0000

LASER CUTTER HANDBOOK:
http://design.umn.edu/current_students/leo/hall/documents/X660.pdf

AUTOCAD LASER TEMPLATE (SAVE AS):
http://design.umn.edu/current_students/leo/hall/laser.dwt
using the LASER cutting system

- draw/place your parts in a box which is the same size as the stock you will be cutting
- make that box a different color than ALL cutting lines
- allow a 1/8” margin around the stock
- vector cutting and vector etching is most effective for line work
- raster etching is most effective for grayscale images - raster etching is slow/expensive
- lines to be vector cut/etched MUST be drawn/saved in .0000 LINEWEIGHT
- avoid stacked lines - if there are 2 lines – the laser will cut twice.
- OVERKILL (acad alias OK) your drawing to optimize for laser cutting.
- like any other cutting tool, you need to consider the width of the cut.
- the laser has a kerf of about .007”.
- power and speed settings are assigned in the print driver according to line color.
- we have saved laser settings for commonly cut materials.
- bring us a small sample of your file before spending days working on it so that we can address any details which will be problematic when it comes time to cut the parts.
- the laser cutter IS NOT on the network, save your file on a USB drive, you can borrow one in the shop office.
using the 3D printer

the 3D printer is a ZCorp Spectrum z510

Get your file to us by one of the following ways:

• USB jump drive
• Email: cdes3dp@umn.edu

Use the following convention for naming your file:
[X.500 USERNAME][DATE][FILE EXTENSION]
e.g., kinde035.02.28.08.stl

Cost:
3D printing costs $3.00 per cubic inch. The total volume of your object(s) is determined by the ZCorp software. You will be notified of the cost of your part before printing.
Payment is due upon removal of your part.
You will be charged for any printer output regardless of the integrity or quality of the part, so it is important that you assess the viability of a file before printing it.

Files Supported:
• .STL - ProE, Maya, Rhino, SolidWorks, Sketchup (with su2stl.rb script)
• .3DS - Autodesk 3DS Max

Color:
The 3D printer will print in 24 bit color. Normally, .3DS files will retain their color after importing them into ZPrint but .STL will not.

Color can be added to your model either in your modeling program or by using ZCorp’s ZEdit software after it has been imported into ZPrint. The ZEdit software is available to use on the 3D printer computer.
**using the 3D printer**

**Size Recommendations:**
- Cantilevers should be shorter than 2" and thicker than 1/8".
- Beams/pillars should be no less than 1/8" square.
- Solid planes should be no less than 1/16" thick if >1" sq and no less than 3/32" if <1"sq.

If your part appears to be too fragile to extract safely, we will let you know before printing.

The print chamber size is 10” x 14” x 8”. Make sure your parts are either scaled to fit that size, or are scalable to that size without becoming too fragile (see size recommendations).

It is possible to orient your part in such a way that you can fit a longer part in the print chamber.

If your file is not 1:1, let us know the dimension of the longest side that you want it scaled to.

**Pre-printing Procedure:**
After we have reviewed your file, it can be printed. Depending upon the number of students wishing to use the 3D printer, your file may be printed in a batch with other students’ files. Therefore, it may be more effective for us to wait until the virtual print chamber is full before printing.

Once the print is ready to go, we can give you an estimate of the time it will take to print. If there are others waiting to use the 3D printer, it is important that you show up on time to remove your part(s). You are responsible for the removal of your parts. Bad things can happen and we don’t want to be responsible for your broken part.

**Parts Removal:**
Extracting your parts from the print chamber can be tricky. Our best piece of advice is to be patient. Allow yourself enough time to extract and clean your part (it may take 30 minutes or more). Rushing to remove your part will most likely result in a bunch of broken pieces. It is also important to be aware of others’ parts that may be in the print chamber.

1. Use ZPrint to locate your part in the print chamber.
2. Press the ONLINE button on the front of the printer.
3. Lower the FEED chamber using the down arrow on the front of the printer.
4. Use the paintbrush and trowels to remove the excess powder from around your part, being careful to not spill outside of the build chamber.
   Be careful to not return broken parts (however small) into the FEED chamber. If your part has crumbled into many pieces and is beyond saving, let a shop technician know before proceeding. Broken parts in the FEED chamber will contribute to problematic print jobs.
5. For tall parts, raise the FEED chamber as you remove powder.
6. Once your part is extracted, use the powder recycling station to blow off any dust that was not removed during extraction. Turn the powder recycling station on by using the power strip above and to the left. On the left side of the station, make sure the hose labelled CHAMBER is in the port labelled SUCTION.

**Strengthening Parts:**
After all excess dust has been removed, you may wish to infiltrate your part with a hardening agent. The following have been used to strengthen parts:

- Cyanoacrylate glue (a.k.a. superglue) Spray varnish
- Spray lacquer (Deft) Acrylic Spray finish