

**Mechanical
Engineering
Machine Shop Safety
and Orientation
Training**

September 21, 2018

Shop Safety

1. Safety glasses are required at all times in the shop.
2. No one is allowed to enter the shop in sandals or shorts.
3. Don't wear jewelry around moving equipment.
4. Long hair must be tied back.
5. Roll up long sleeves around moving equipment.
6. Ear protection, goggles, face shields, shop coats, and first-aid kit are available in the shop.
7. Be careful when handling vises, rotary table, indexer, chucks, or other heavy items to avoid dropping or back injuries. Ask for help if needed.
8. Do not direct compressed air toward skin.
9. Remember – **round things roll**.
10. Only minor sanding is allowed in the shop. Larger scale sanding and painting should be done in the paint booth.
11. If unsure **How** or **Why** – **ASK!**
12. Regular shop hours – 8:00-11:30, (11:30-12:30 Lunch), 12:30-5:00 Monday-Friday
13. Summer shop hours – 7:30-11:30, (11:30-12:30 Lunch), 12:30-4:30 Monday-Friday

Shop Scheduling

1. Sign up to reserve machines on scheduling board.
2. You have a grace period of 15 minutes to show up for your scheduled time slot. After 15 minutes, the machine is open for anyone to use.
3. Sign-up with your name, your mentor's name and time range of use.

Cleanup

1. Brush chips off entire machine after each use. Shop-vacs can be used when chips are **NOT** long and stringy.
2. Do **NOT** use compressed air to blow chips off machines.
3. Wipe down machine with shop towels.

4. Sweep floor in affected area; Do not allow excess chips to build up on floor because they will migrate around the shop.
5. Mop floor if necessary to remove oil or coolant. Mop is located next to welding area along with soap.
6. Put used shop towels in metal canister. Shake out **ALL** chips into trash can first.
7. Put **ALL** tools back in the proper place.

Signage

Refer to signage on machines and walls for important notes on machine use or general machining.

Mindworks

Shop guides and resources have also been collected online for student learning and use.

http://mindworks.shoutwiki.com/wiki/Main_Page

Shop Computers

The shop (2) computers are to support machining with the CNC lathe and/or CNC mill. *This is their sole use; use CAD laboratory computers for other uses.*

Grey Cabinets

These two cabinets (#2 and #3) contain tools and supplies available for shop usage.

Shop towels and cutting oil are located on top of these cabinets.

Tool sign-out sheet – Tools must be signed out if taken out of shop, except when used in the design suite. Tools should be returned to the shop before it closes each day.

Shop Manager's Area

This area including the Bridgeport mill, tool boxes, cabinets and corner area is off-limits to students without shop manager's permission.

Light Brown Cabinet #5

This cabinet contains measuring tools available for shop use.

Red CNC Cabinet #6

This cabinet contains deburring tools, hand tools, and cutters that are only to be used with the Haas CNC mill. Deburring tools and other hand tools are for general use.

Stock Cabinets and Racks

Stock and hardware in these cabinets are for student use on school projects. When placing leftover material here, label it with its alloy, if known, and put in the appropriate area. Use material identification guide and scratch tests to verify material before cutting.

Pay special attention to identifying steel vs. aluminum. They have different hardnesses, requiring different machine settings.

If you have questions on a what a material is, ask the shop manager.

Drill Press

1. Clamp parts before drilling, especially small or thin parts, such as sheet metal.
2. Use cutting oil when drilling.
3. Removing chuck or taper-shank drills with drift punches.
4. Changing speeds
5. Adjusting table heights.
6. Quill stop
7. T-nuts for Wilton drill press.
8. Clamping the workpiece
9. Do **NOT** use end mills in the drill press.
10. Refer to cutting RPM charts on walls for drilling speed. Cobalt drills use high-speed steel speeds.

Drilling

Center drilling

- Select a center drill similar in size to drill bit.
- RPM is relative to average diameter of tip and body sizes.
- Use cutting oil

Drilling

- Check drill bit size before drilling. Do not trust that bits got put away correctly.

- Holes up to ½" diameter do not have to be stepped up in size.
- Holes over ½" diameter should be stepped up roughly every ¼" in size.
- When drilling holes to be tapped – refer to chart in shop for drill size.
- When drilling holes to be reamed – leave 1/64" for reaming holes under ½", 1/32" for reaming holes every ½".
- Use cutting oil when drilling. Koolmist may also be used but it tends to run off immediately.
- When drilling acrylic, stick-wax or cutting oil both work best.
- Coolant not necessary for drilling cast iron.
- When drilling stainless steel, cobalt drill bits work best.
- When drilling sheet metal, always use Uni-bits.
- **Make sure parts are properly clamped.**

Drills Available

- Number drills - #1 to #60
- Letter drills – A to Z
- Fractional Drills – 1/16" to ½"
- ½" Shank Drills – 1/16" to ½"
- Morse Taper Shank Drills – ½" to 1 7/16"
- Cobalt drills – up to ½"
- Uni-bits – up to 1"

Tapping

- You should receive a tapping demonstration from your mentor.
- It is important to start **straight** into holes. This can be done with a tapping guide block or on the milling machines.
- Be sure to drill deep enough to allow room for chips to build up when tapping blind holes.
- Pipe taps – Tap down approximately 2/3 of tap threads and check for fit with fitting. Remember, the threads are tapered.
- Always use lubricant, except for cast iron.

Belt Sander

- Do **NOT** use gloves while sanding.
- Do **NOT** force parts into belt.
- Parts can get caught between plate and belt.
- It is OK to sand both ferrous and non-ferrous materials.
- Clean after each use.

Vertical Bandsaw

1. Select the proper blade for your application as follows:
 - 6-tooth blade for aluminum, brass, plastics
 - 18-tooth blade for steel and stainless steel
 - 24-tooth blade for ALL materials that are 1/8" or less (Especially steel and stainless steel)

The 6-tooth and 24-tooth blades are stored at the back of the bandsaw.

2. If necessary, install the correct blade in the bandsaw.
3. Set the blade tension.
4. Make sure that the blade guard is in place.
5. Adjust the upper blade guard so that it is about ¼" above the part to be cut.
6. Make sure that the bandsaw is set to the proper speed.
THE MACHINE MUST BE RUNNING TO CHANGE SPEEDS!
7. Use constant, firm pressure when sawing. Don't try and force the workpiece through too fast. This may cause teeth to be stripped off the blade. There is a tube of wax that can be used for lubrication. Just press the tube into the saw blade while it is running and it will coat the blade.
8. **DO NOT USE OIL ON THE BAND SAW.**
9. When finished with the saw, **make sure the blade for cutting steel (18 tooth)** is installed and the speed is set for steel.
10. Clean the bandsaw.

Horizontal Band Saw

1. Make sure that the bandsaw is set to the proper speed.
THE MACHINE MUST BE RUNNING TO CHANGE SPEEDS!
2. Turn on coolant if needed.
3. Use stock stop and set vise for angled cuts as needed. **Make sure blade is squared up again when finished with angled cuts.**
4. When finished with the saw, **make sure the cutting speed is changed back to steel cutting speed.**
5. Clean the bandsaw.

Sheet Metal Equipment

Maximum Capacities:

Mild Steel	.0598	(16 Ga)
Aluminum	.063	
Stainless	.035	(20 Ga)

DO NOT EXCEED THESE LIMITS. If your material exceeds these limits, work must be done at a different shop.

Welding Area

Students may use the welding area without a mentor after they have received appropriate training. The shop manager's approval is required each time the equipment is to be used.

Mills and Lathes

- These machines always require shop mentor assistance for use.
- Your mentor will give training before use.
- Must have a machine plan before use. Review this with your mentor before your scheduled shop time.

Authorization for students to begin working in the Mechanical Engineering Machine Shop requires orientation about the following:

- **Shop Safety**
- **Cleanup**
- **Tool Storage Cabinets**
- **Drill Press**
- **Drilling**
- **Tapping**
- **Belt Sander**
- **Band Saws**
- **Sheet Metal Equipment**

A sheet with names of all students who have received basic training and are authorized to work in the shop will be posted at the entrances to the shop.

Authorization means that students can work on the drill press, belt sander, sheet metal equipment and band saws without mentor supervision.

Use of mills, lathes and weld area require mentor supervision or separate authorization.

Give this form to your mentor to turn into shop manager.

Name of trainee (Print)

Name of mentor (Print)

Date