

Hand Tools:

General information:

- The Greatest hazards posed by hand tools result from misuse and improper maintenance.
- Safety requires that the floor be kept as clean and dry as possible to prevent accidental slips with or around dangerous hand tools.

Hammers:

- Use them to strike objects to position or mark them, or drive fasteners.
- Don't ever strike two hammer heads together, they may shatter.
- Use soft hammers (mallets) for positioning.
- Use ball peen hammers for metal work.
- Use an appropriate type and size hammer for the job.
- Make sure that the hammer head is securely attached to the handle before using.



Chisels and Punches:

- Use them to remove material or mark a drilling position.
- Wear a Face Shield when using a chisel.
- Plan where the chiseled parts will fly and take precautions to protect
- Don't use chisels with a "mushroomed" head. The heads might shatter on impact, sending sharp fragments flying.
- Use the appropriate chisel for wood or metal
- Drive a wood chisel with a mallet.
- Drive a metal chisel or punch with a Ball Peen hammer.



Saws:

- Hacksaws are for metal, wood saws are for wood.
- At least three teeth must span the thickness of the material to be cut.
- Keep hands out of the plane of the blade.
- Keep hands on top of the material and visible.
- Start and end your cut gently for accuracy.
- Coarse teeth are for “soft” materials. Fine teeth are for “hard” materials.



Screwdrivers:

- Use them to drive or loosen screws and fasteners.
- Use the correct type that fits the fastener:
 - o Flat Blade/Standard (straight blade)
 - o Phillips (x-shaped)
 - o Torx (star shaped-6 points)
 - o Allen (fits into a hexagon shaped hole)
 - o Nut Driver (fits over hexagon shaped)
- Use the correct blade SIZE that fits the fastener type.
- Don't ever misuse a screwdriver as a chisel or prybar.
- Don't use a screwdriver if the tool tip is worn or damaged.



Pliers and Wrenches:

- Use Pliers to grip surfaces and objects with irregular shapes.
- Don't ever hammer on the handle.
- Don't grip Pliers with your fingers between the handles, as they will be pinched if the tool slips.
- Keep the jaws parallel or the handles close together for the safest grip.
- If the part is too big, use a pipe or strap wrench.
- Pull towards yourself, don't push, for safe control.
- Must fit the part snugly to prevent slipping and injuring you.
- Never use pliers or pipe wrenches on parts with flat sides.
- Don't use extensions or "cheaters", you will break or bend the tool.
- Use Wrenches to tighten or remove nuts and bolts or objects with flat surfaces. Do not use a wrench if the jaws are sprung (not parallel).
- Don't use Pliers on parts with "flats" (i.e. nuts, bolts, plumbing valves, precision parts), as they will damage the surface.



Knives:

- Use them to cut various materials.
- Cut away from yourself and others.
- Don't use dull blades. Dull tools can be more Hazardous than sharp ones.
- Retract or close the blade when done.
- Don't hit or strike them with anything.



Files:

- Use them to shape a material and remove burrs after it has been cut.
- Must always have a handle on the file.
- Don't ever use them as a pry bar or hammer, they are brittle and will break.
- Don't run your hand over the surface you're filing – your body oils slow down the cutting action and you could get slivers.



Measuring Tools:

- Use them to measure repeatable inside and outside dimensions.
- Retract tape measures slowly to avoid breaking the tape.
- Keep measuring tools clean.
- Don't mark up or abuse rulers or use them as hammers, pry-bars, etc.
- Clamp measuring tools gently for accuracy and to prevent tool damage.
- Handle calipers and micrometers with care, clean measuring faces between uses and ALWAYS place them back in their cases when you are not holding them in your hand.



Sheet Metal Shears:

- Use them to cut sheet materials only, mostly sheet metal.
- Watch out for sharp edges.
- Don't force cuts on thick metal, use other tools, i.e. horizontal band saw, vertical band saw, etc.
- Don't ever cut wire or round stock. It will ruin the blades.



Taps:

- Use them to make internal threads in holes in metal.
- Use the proper size tap in the proper size hole (see the tapping chart BEFORE you drill!!)
- Turn the tap with a tap handle that fits it.
- Use tapping fluid to prevent binding the tap.
- Rotate $\frac{1}{4}$ turn, then reverse to break and clear out the chips.
- Taps are brittle, so enter the hole straight, don't try to bend them, don't strike them.
- Don't force it! If it sticks or is hard to turn, ask for help.
- Small taps are very easy to break, turn them very gently.

Dies:

- Use them to make external threads on rods or shafts of metal.
- Start squarely on the chamfered end of a proper size rod (nominal size of the thread or preferably .002 to .005 inch undersized).
- Use appropriate die holder.
- Start with the leading side of the die (it has a chamfer on the first 2 or 3 threads and is wider).
- Do not try to extend the threads on a hardened bolt, it will ruin the die.

Reamers:

- Used to remove small amounts of metal in holes to make precise diameters.
- Never rotate them backwards, their cutting surface may chip.
- Use cutting oil or tapping fluid.
- Power-ream only at VERY SLOW speeds.



Electric Hand Tools:

- Before using, inspect the cord for missing prongs, frays, cuts, and other damage.
- People using electric power tools must be aware of several dangers; the most serious is the possibility of electrocution. Under certain conditions, even a small amount of electrical current can result in fibrillation of the heart and eventual death.
- A portable power tool must be double insulated, have a 3 wire cord (2 current carrying conductors and a grounding conductor) plugged in to a grounded outlet, or be powered by a low voltage transformer to be safely operated.
- Never cut off the third grounding prong of a 3 wire plug.
- If an adapter is used to accommodate a 2 prong receptacle, the adapter ground wire must be connected to a known ground.
- Insulation protects the user in 2 ways – The normal insulation of wires inside the tool, and a non – conductive tool housing.
- Always operate power tools according to the manufacturer’s instructions.
- Use the right tool for the job. Power tools should be operated within their designed limitations.
- Examine each tool for damage before use.
- Keep all tools in good condition with regular maintenance.
- Use the proper protective equipment.
- The work area should be well lighted.
- Guards, as necessary are provided on power tools to protect the operator and others from rotating parts, flying chips and sparks, pinch points (nip points), and points of operation (switches, adjustment levers, etc.)
- DON’T use a tool if the cord or the tool is damaged or the tool makes funny sounds. NEVER carry a power tool by the cord. Don’t use electric tools in damp locations.
- ALWAYS Unplug the tool to change bits, blades, etc. Never pull on the cord to unplug the tool.
- Remove chuck keys and tightening tools IMMEDIATELY.
- Make sure that the RPM (speed) of the tool does not exceed the rating of the bit, wheel, blade, etc. that you use. Otherwise, it may fly apart.
- Wire brushes often throw wires, wear Safety Glasses and a Face Shield and protect others around you.
- Don’t put the tool down until the motor completely stops. NEVER carry a plugged in tool with your finger on the switch button.
- Watch what’s on the other side of what you’re drilling or cutting, and don’t put your hand there.

- Use a Face Shield when working with materials or tools that may throw debris, especially high-speed tools like routers. All moving parts of any equipment must be guarded. Safety guards must never be removed when the tool is being used.
- Gloves may be acceptable in some circumstances, ask permission to use them with any power tool. Wear safety footwear if required.
- Be aware of fire or burn danger when using soldering tools or heat guns. Always place hot tools and objects on a non-flammable surface.
- Don't exceed the capacity or force the tool.

ELECTRIC DRILL:

- Use it to drill holes in metal or wood.
- First, center punch the hole to be drilled, especially in metal.
- Tighten the drill using the chuck key and remove the chuck key IMMEDIATELY.
- Securely clamp the work-piece before drilling. A work-piece that moves when being drilled can break the drill, injure the operator and destroy itself.



- Hold the drill motor firmly, and keep hands away from the revolving spindle and drill.
- Use a larger drill if a larger hole is needed. Using side pressure on the drill to "wobble" out the hole to increase the diameter will only damage the drill and cause it to break.
- Apply straight and steady pressure on the drill, and ease up on the pressure as the drill begins to break through the material.
- With the motor still running back out the drill as soon as the hole is drilled.
- Turn off the drill and hold firmly until it comes to a complete stop before laying it on the work bench.

JIG SAW:

- The saw should be placed on its' side on the workbench when not in use.
- Use it to cut straight and curved shapes out of metal or wood.
- Select the proper blade for the material to be cut, and secure the blade in the saw before plugging in the electric cord.
- Hold the saw down firmly against the work-piece to prevent vibration or injury.
- Use a relief cut on corners to prevent binding or pinching the blade. This will prevent the blade from breaking.



PORTABLE BELT SANDER:

- Use it to sand wood or plastic materials to a flat surface.
- Place the sander on its side before plugging the power plug into the outlet.
- Securely clamp the work-piece before sanding.
- Start the sander before touching it to the surface to be sanded.
- Disconnect the power plug before changing the sanding belt.
- The weight of the sander will apply adequate pressure to the sanding surface in most cases.
- Do not apply so much pressure that it causes the sander to slow down.



PORTABLE DISC GRINDER and SANDER:

- Use the Disc Grinder and Disc Sander to sand steel materials only.
- You must wear a Face Shield as well as Safety Glasses when using a disc grinder. This tool may throw off flying fragments.
- Carefully inspect the entire disc or blade before using. Don't use if cracked, chipped, etc., it could explode.
- Always store the tool with the disc facing up to protect the shaft bearings.
- Always be aware of the direction you are throwing the stream of sparks. It is your responsibility to be sure you are not throwing sparks on other people, in the vicinity of those without eye protection, or on potentially flammable items.
- The disc grinder must be stopped (not moving) before it can be set down. DO NOT clamp a hand held grinder in a vise.



POWER HAND SAW (SKIL SAW):

- Use the Skil Saw to cut sheets or boards of wood.
- You must wear a Face Shield as well as Safety Glasses when operating the Skil saw.
- NEVER disable the blade safety guard, or use the saw if there any problems with the safety guard.
- Stand to the side of the saw in case it “kicks back”.
- Unplug the saw before handling or changing the blade.
- Limit the blade extension to 1/4 inch below the piece being sawed.
- Hold the saw firmly with both hands before turning on the power.
- Support the wood being cut so that it doesn’t “pinch” the blade and stop the saw, or doesn’t break off near the end of the cut.
- Select the proper blade for the cut to be made. Check the blade to be free of cracks or nicks, and that it is sharp.
- Feed the saw at a moderate rate; too slow of a feed rate will cause burning of the wood, too rapid a rate will produce a rough splintery surface.
- Be aware of what’s under the material you’re cutting! (i.e. fingers, edge of the table, metal saw horses, etc.)



Air Hand Tools:

- Inspect the air hose for leaks, stripped fittings, and other damage. Don't use if damaged!
NEVER carry the tool by the hose. Don't pull on the hose to disconnect it from the connector.

BLOW-OFF GUN:

- Blow off guns should NEVER be used to clean machines.
- Use a Blow-Off Gun to clean chips and debris off of cut materials. ALWAYS put a rag over the part to catch fling chips, etc.
- Don't point a blow-off gun at yourself, it can drive particles under your skin or tear skin from your flesh.
- You are responsible for insuring that your use of air tools does not injure others, i.e. do not blow chips towards someone.
- All Blow-Off guns MUST have a perpendicular hole through the tip to relieve excess pressure if the Gun is pressed against your skin.



STATIONARY POWER TOOLS:

DRILL PRESS:

- Use a Drill Press to drill holes accurately and vertical to the part surface.
- Use a center punch to help locate the hole to be drilled in the correct place.
- Drilling soft materials such as brass, copper, or plastic is done with a drill ground differently than drills used for steel.
- Hold round stock securely with a “Vee block” in a vise.
- All work must be held securely for drilling by using either a drill vise or C-clamps. A work-piece that moves when being drilled can break the drill, injure the operator and destroy itself.
- Don’t drill into the vise or table. Use wood under “through” holes.
- REMOVE THE CHUCK KEY IMMEDIATELY AFTER TIGHTENING OR REMOVING A DRILL! Leaving it in creates a high risk of injury or damage.
- Select the correct speed for the material and size drill being used.
- Large work-pieces must be set firmly against the left side of the drill press column so that if the drill grabs, it cannot spin the work-piece and cause injury to the operator or others.
- If the drill grabs the work piece and it is yanked loose of the clamps and begins to spin, maintain downward pressure with the press and turn off the power. Do not retract the drill as this would allow the work-piece to be thrown from the press and may cause serious injury.
- Hands are to be kept clear of the revolving spindle, chuck, drill and chips.
- Always ease up on the feed or drill pressure as the drill begins to break through the work-piece. Heavy feed pressure will cause the drill to dig in, and could damage the material being drilled, break the drill, or cause the workpiece to spin.
- When drilling large holes drill a pilot hole with a small drill such as 1/8 inch and then step up in sizes to prevent drill chatter.
- Be sure the drill press is stopped before removing the work-piece, or clearing chips or cuttings



BANDSAW – VERTICAL:

- Use a Bandsaw to cut straight or curved pieces from metal, wood or plastic objects of various shapes and thicknesses.
- When feeding a work-piece into the bandsaw blade your hands should not be in line with the blade in case you slip or lose balance.
- Use only the correct blade for the material being cut. (Fine blades for steel, coarse blades for aluminum, plastic or wood.)
- Adjust the blade guides and rollers properly, and adjust the speed. The upper saw guide should be about 1/4 inch above the work-piece.
- Check the work-piece to be sure it is free of debris (i.e. rocks, tool bits, nails).
- Plan the cut to prevent backing out of a cut, as this will pull the blade off the wheels. Make relief cuts as needed for tight radius areas.
- Holding the work-piece firmly, start it gently, feed it at a moderate rate.
- Use a push stick when sawing small or difficult to hold pieces.
- A minimum of three teeth must be engaged in the work-piece at all times or the teeth will be torn off of the blade.
- Hold round stock securely with a “Vee block” in a vise.



BANDSAW – HORIZONTAL:

- Use a Horizontal Bandsaw to rough cut thick metal stock, using gravity to “push” the blade through the material.
- Clamp the work-piece snugly in the vise, but don’t over tighten!
- The vise jaws must be parallel. Use a spacer block when cutting short or odd shaped pieces to keep the jaws parallel.
- Support the descent of the saw with your hand as it starts the cut, or for the entire cut when cutting thin stock or if the saw drops rapidly.
- Adjust the blade guides and rollers properly, and adjust the speed. The leading saw guide should clear the jaws when it descends, but be as close to the jaws as possible.
- Check the work-piece to be sure it is free of defects (i.e. broken off tool bits, nails, etc.).
- A minimum of three teeth must be engaged in the work-piece at all times or the teeth will be torn off of the blade.
- Hold round stock securely with a “Vee block” in the vise.
- Wait for the coolant to run through the blade before starting the cut.
- The Horizontal Bandsaw is a flood coolant machine, the fluid that flows over the blade is recirculated. If the fluid is not flowing, don’t use the machine. Inform the machinist immediately and it will be refilled.



STATIONARY DISC / BELT SANDERS:

- Use the belt and disc sanders to smooth or shape the edges of materials.
- Check the sanding belt or disk to make sure it is in good condition and not torn. The Shop Tech will replace worn belts or disks for you.
- Keep fingers and hands clear of the moving or rotating surface.
- Hold the work-piece securely and use only moderate pressure.
- To grip small parts safely, **ONLY** use Vise-Grip (Locking) Pliers.
- Sand only on the downward motion side of the Stationary Disk Sander.
- Move the work-piece side to side on the sanding surface to prevent rapid wear of the belt or disc.



BENCH GRINDER:

- Stand to the side of the grinder, not in line with the wheels, when turning on the grinder and while the wheels are accelerating, as this is the most common time for a damaged wheel to fly apart.

- Do not allow hands to come in contact with the grinding wheel while it is in motion.

- Don't use a grinding wheel when it is worn, uneven or out of round. Have a machinist "dress" it square and round.

- Use only enough pressure to assure grinding, but not heavy pressure as this will only cause overheating and grinder damage.

- Grind only on the face of the wheel. Grinding on the side can cause the grinder wheel to explode due to heat stress buildup.

- To grip small parts safely, ONLY use Vise-Grip (Locking) Pliers.

- Carefully inspect the entire wheel(s) before using. Don't use if cracked, chipped, or clogged with metal, they could explode. Report damage to the machinist who will change it for you.

- Hold the work firmly, and grind without bumping or impacting the grinder wheel.

- When the work-piece begins to get warm, quench it in water.

- Keep the work-piece in motion across the face of the wheel.



WIRE WHEEL / CLOTH BUFFER:

- Use the Wire Wheel to remove paint and rust from metal. Use the Cloth Buffer Wheel and Rouge Abrasive to polish the metal to a shiny surface.
- You must wear a Face Shield as well as Safety Glasses when using the wire wheel/cloth buffer.
- Hold the work-piece firmly with both hands.
- Keep hands away from the wire wheel or buffer while it is in motion.
- To grip small parts safely, ONLY use Vise-Grip (Locking) Pliers.
- If buffing, apply Rouge buffing compound sparingly to cloth buffers.
- Using excessive pressure will cause the work-piece to overheat and damage the surface.



HAND ARBOR PRESS:

- Shield brittle materials a full 360 degrees (i.e. ball bearings without a bearing puller, hardened or brittle materials), to protect others.
- Use the Arbor Press to install or remove items that “press-fit” into holes.
- Wear a Face Shield and Safety Glasses when operating the arbor press.
- Make sure the set-up is stable and aligned with the force to be applied.
- Don’t stack spacers, blocks, etc. unless absolutely necessary.
- Chamfer ends of shafts and holes so parts self-align as they’re pressed.
- Use even pressure, start carefully.
- Lubricate all interference fits.
- Use a bearing puller to remove ball bearings.



TABLE SAW:

- Use a Table Saw to make straight, precise cuts in wood sheets or boards.
- Select the proper blade for the cut to be made. Check the blade to be free of cracks or nicks, and that it is sharp.
- Unplug the machine before handling or changing the blade
- Limit the blade extension to 1/4 inch above the piece being sawed.
- The table saw is for cutting dry wood
- Use the ripping fence or the angle guide when cutting material, but don't use both of them at the same time!
- Keep a push stick available and use it to keep your fingers away from the blade.
- You must ask the machinist's permission to use the table saw.
 - When using the fence to rip cut a work-piece, the operator and all observers must stand to the side of the work-piece. It can get pinched between the spinning blade and the fence causing it to "kick back" (be fired straight back out of the saw at a very rapid rate).
 - Feed the work piece at a moderate rate, but not so fast the motor slows down.
 - When cutting large or long pieces on the table saw, use an assistant to SUPPORT the edge or end of large or long pieces being sawed. The assistant does not "feed" the material into or pull it through the saw. [This could cause the operator to lose their balance if the work-piece moves too rapidly and the operator may fall into the blade.]
- Make sure the table saw has a blade guard, splitter, and anti-kickback device installed and operational before using the saw. Exceptions may be made for specialty cuts.



Sheet Metal Tools:

- Do not exceed the capacity of the sheet metal tools (.060" for steel, .100" for aluminum)!
- NEVER cut round materials (wire, bolts, rod, etc.) in sheet metal tools, because the cutting surfaces will chip or break.
- Avoid pinching your or someone else's hands in the mechanism.
- Always operate the sheet metal tools while standing in front of them.
- Ask the machinist's permission to use Gloves to avoid cuts while using sheet metal tools.
- Don't force the tool, if it doesn't cut easily, ask for help!
- Dispose of sharp scrap carefully.

SHEET METAL SHEAR:

- Do not cut round stock or anything except sheet metal in the shear!
- Place the sheet against the guide and then clamp it in position with the clamp on the machine.
- Use the Shear to cut large sheets of metal.
- Keep fingers and measuring scales out of the way of the blade.
- Don't jump up and down on the treadle. Operate with one foot, or stand on it and use the other foot to stomp the treadle down.
- Return the treadle to the up position slowly with foot pressure. Do not let it make a rapid return.
- Pick up the scrap pieces when you have completed cutting.



SHEET METAL BRAKE:

- Keep fingers clear of the jaws of the brake.
- Bend only sheet stock in the brake. No round stock!
- Use the Brake to bend angles into pieces of sheet metal only.
- Adjust the clamping bar correctly to fit the gauge of metal being formed, and stand clear of the moving parts of the brake.



SHEET METAL ROLLER:

- Use the Roller to roll curves into pieces of sheet metal only.
- Keep fingers clear of the rollers.
- Adjust the clamping bar correctly to fit the gauge of metal being formed, and stand clear of the moving rollers.



Remember: When finished using a tool clean it up!

Confirmation Code:

Drill Press

You will need this code in order to take the safety quiz.

(Note that confirmation codes may change daily)

Next Step

If you have reviewed the Shop Overview Video, and the three safety training documents, you can now take the safety quiz at the link below. *Note: You will need the three confirmation codes from the three training documents in order to take the quiz.*

Safety Quiz Link:

https://delaware.qualtrics.com/SE/?SID=SV_dcith4lu9HLYzFb