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# **General Tool and Fabrication Lab Safety**

- We have a **ZERO TOLERANCE** policy towards unsafe student practices.

Directions: Please carefully read each section and “fill” or “check” the box provided for each statement. When completed with each page initial on the lower right of the page which indicates you have read each page /statement.

## **The student will be removed from the *Design Technology Program* for the following:**

- The students' action may be harmful to themselves or someone else.
- Practicing unsafe actions.
- Continuous interruption of class or safety lessons.
- Not following all safety rules and instructions.
- Not wearing safety glasses or safety equipment.
- Damaging or theft of tools or equipment.
- Not showing respect for the teacher, other students and equipment.
- Being under the influence of drugs or alcohol.

## **General Hazards of Tool Use**

- There are a variety of hazards associated with improper tool use and faulty tools.
- Some of these hazards are unique to a tool while others are common for many types of tools.
- Examples of hazards and associated injuries include the following:
- Being struck by a tool, moving machine, or moving part can cause bone fractures, concussions, and internal organ damage.
- Rotating blades, drills, and other cutting tools can cut and puncture tissue.
- Objects can fly off from many tool operations. Depending on an object's size, shape, speed, and material, it can cause a variety of injuries to various body parts. Small flying objects are a particular hazard to the eyes.
- Body parts can get caught in gears, belts, shafts, etc. This can crush bones and tissues.
- The power source of a tool may present a hazard on its own. For example, electricity can cause burns and shocks. Electric shocks can paralyze the nerve centers, stop breathing, and stop the heart. Heat from the electric current can burn the skin and damage internal organs. Other power sources like gasoline can combust and start fires.
- Tools can create noise hazards and hearing damage. Depending on the material being cut, shaped, or sanded harmful air contaminants can be produced. Tools can also become very hot or cold, causing burns.
- All the above hazards can also cause major body harm and injury; including death.

## **General Safety Practices**

- General safety rules apply to both stationary and portable power tools.
- ALWAYS wear safety glasses.
- Tie back long hair.
- Do not wear loose clothing. Tuck in shirts, and roll up sleeves.
- Do not wear sandals or other open toed shoes.
- Keep machines and work areas clean and free of oil and metal chips.
- Do not leave tools lying around. Return them to their storage location when done.
- Keep tools clean and free of oil.
- Never leave a machine until it is completely stopped.

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### General Safety Practices (continued)

- Do not tamper with machines.
- Do not lean on machines, running or not.
- Do not wear gloves when operating machine tools.
- Do not wear rings or loose jewelry. Remove them and place them into your pockets.
- Do not attempt to operate any machine until you are familiar with the controls and safety precautions.
- Do not talk to, or distract, someone who is operating a machine.
- Everyone helps with general clean-up at the end of the period.
- Horseplay, swearing, running and talking to the operator of a machine are not permitted.
- Keep your work area and bench tidy.
- Water, glue, and oil should be wiped up immediately if spilled.
- Be careful when carrying sharp tools and long objects.
- A machine can be used only when the instructor is present, permission has been received, and the student has received instruction in its operation and safety precautions.
- Make all adjustments before the machine is turned on, use the safety guards and push sticks.
- Power tools should not be left while they are still running, power on or off.
- Power tools should not be slowed nor stopped with hands or sticks.
- Machining short pieces of stock under 6" must be okayed by the instructor.
- One person will operate a machine only, unless instruction or assistance by the instructor is required.
- Any faulty equipment shall be reported.
- The use of power tools and driven machinery is a privilege "Think Safety".
- When in doubt – STOP**.....seek additional information or directions.

### General Lab Clean-Up and Maintenance

- It is up to each and every student to clean and maintain the fabrication lab on a daily basis.
- Each student must follow their specific clean-up activity based on the location defined on the clean-up chart.
- Each student will clean-up any machine used immediately after use to create a safe and clean environment for the next user.
- Each student will keep their work area neat and organized while they are working and completely clean their work area of scrap, debris and return all tools to their proper storage location.

### Surrounding Environment

- Know the location and use of all red "**EMERGENCY STOP BUTTONS**"
- Know the location of the "**FIRST AID KITS**"
- Know the location and use of the "**EYE WASH STATION**" and "**SAFETY SHOWER**"
- Know the locations of fire extinguishers and fire blankets. They shall be the correct type (e. g., A, B, C, D) for the potential fires which could occur in your shop. Also, know where the fire alarm is located and the proper exit route(s) for your work area.
- Keep all cabinet doors and drawers closed at all times. Students should promptly remove tools or supplies for cabinets or drawers in an effort to keep all pathways clear and safe.
- Your work area shall be kept clean! Oily rags, dust, and paper are fire hazards and can damage your tools. Place scrap materials in appropriate containers.
- Keep your work area well lit. If you can't see your work, then you can't see a hazard.
- Keep your area dry. Wet floors and work surfaces can cause slips. Water serves as an excellent electric conductor between the ground, you, and your tool!
- Before working with tools that can produce sparks, make sure that the surrounding area is free from ignitable materials.

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## **Personal Protective Equipment (PPE) and Personal Hygiene**

- Always wear ANSI-approved safety glasses or face shield when operating or observing the sand blaster to reduce the risk of eye injury or blindness from flying particles. Everyday eyeglasses are not approved safety glasses.
- Use protective equipment when necessary. Safety glasses must always be worn in the fabrication lab at all times.
- Noise produced by power tools can drown out other sounds in the lab... like a person shouting, "STOP!" or "HELP!" Stay alert to your surroundings.
- When cutting certain materials like plastics or epoxies, fumes can be released. Dust is produced when using most every shop tool. To address these potential hazards, discuss the appropriate controls and respiratory protection with your teacher.
- Consult individual MSDS and contact the instructor for assistance with the following specific PPE requirements:
- Personnel must change clothing if it becomes contaminated with paint spray chemicals in order to minimize skin contact. Students' clothing shall not be left on the premises overnight unless kept in metal lockers.
- Personnel shall wash their hands, face, and any other affected areas prior to eating, drinking, smoking, applying cosmetics, or using the rest room.
- An emergency eyewash station shall be located in the immediate vicinity of each paint spray operation and the hazardous material storage area. The eyewash station must be capable of providing 15 minutes of continuous flushing with potable water. Emergency eyewash stations shall be kept clear and unobstructed.

## **Clothing or Work Attire**

- Never wear loose clothing including hoodies, hats, and/or jackets.
- Do not wear sandals or other open toed shoes.
- Never wear jewelry that can entangle in power tools. Jewelry can serve as a conductor of electricity.
- Never wear neckties or anything that has a draw string.
- Wear non-slip footwear to avoid accidental slips which could cause a loss of work piece control.

## **General Hand Tool Safety**

- Always keep your tools clean.
- Oil can cause the tool to slip off an object or out of your hands.
- Dirt and grime can impair the movement of the tool, requiring more pressure. This can lead to injury.
- Wherever possible clamp the object you are working on rather than holding it in your hand.
- Many workers' hands have been injured from slippage of tools like screwdrivers.
- Never use an un-insulated hand tool for electrical work.
- Carry tools in a toolbox or tool belt.
- Tools, especially those with sharp points or edges, carried in pockets can puncture the skin, cause bruises, and get entangled in machinery.

## **Hand Tool Safety**

- Injuries from hand tools are often caused by misuse.
- Workers often assume that they know how to use a common hand tool.
- Like all tools, hand tools must be maintained properly for effective use and safety.
- Always use the right tool for the job! Forcing a small tool to do a big job causes the tool to strain. Strained tools can kickback or break, causing injury.
- Never use a tool which you are unfamiliar with. Get proper training from your teacher.
- Before each use, inspect your tools. Check the alignment of moving parts, breakage of parts, and cracks.

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## **Hand Tool Safety (continued)**

- Before each use, inspect your tools. Check the alignment of moving parts, breakage of parts, and cracks.
- When you're tired, your attention span is reduced. Attention to your work is very important when working in the shop. Make sure you're fit to do the job!
- Be wary of dropping tools. Don't rest a tool on the edge of the workstation. Secure tools when working at heights.
- When using both portable and stationary tools, grip the tool and material being worked on firmly. Hold tools only by insulated grasping surfaces. The material being worked- on should be well secured.
- Make sure that you are well balanced when operating a tool. Sometimes, a "kickback" from a tool can throw the operator off balance, causing injury. Don't work in an awkward position. You may not have complete control of the tool or the material you are working on.
- Never lock a tool in the ON position if you are working under conditions which require you to stop the tool quickly.
- Guarding is one of the best ways to minimize a hazard. Make sure that machine guards are in place on large and small equipment.

## **Maintaining and Repairing Tools**

- Install or repair equipment only if you are qualified. A faulty job could cause serious injuries from mechanical failure, fire, or shock.
- Maintain tools in proper working condition. Regularly inspect tools, cords and accessories. Repair or replace problem equipment immediately. Keep tools sharp, well-oiled and stored in a dry place.
- Never alter a tool in a manner which reduces its effectiveness or safety.

## **Tool Power Sources**

- Tools are powered by a variety of sources. Unique hazards exist depending on a tool's power source.
- Electric shock is the primary hazard from electric powered tools. Most electric shocks from tools have been caused by the failure of insulation between the current- carrying parts and the metal frames of tools.
- Disconnect the power source when performing maintenance, cleaning, or changing blades and bits.

## **Extension Cords / Power Drops**

- Faulty or misused extension cords or power drops can present serious hazards.
- Inspect cords regularly. Look for signs of stretching, insulation damage, and kinking.
- Keep cords and cables clean and free from kinks. Kinking can damage both the cord's insulation and internal wire.
- Never carry a tool by its cord!
- When using tools which require a third wire ground use only three wire extension cords with three-pronged, grounding plugs and three hole electric outlets. Never cut off the grounding plug from a cord! If you see a cord with the grounding plug missing, remove the cord from service.
- Pulling on electric cords can damage the cord insulation and cause electric sparks. Always remove the cord at the plug.
- Extension cords may present a tripping hazard. Make sure that cords are not located in walking paths or a non- trip cover is placed over cords.
- Always use the correct extension cord for the job. An undersized cord can cause a drop in tool power and overheating. Consult the cord manufacturer's recommendations for cord length and gauge.
- Never swing power drops as this may result in an injury to others.

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## **Pneumatic Powered Tools / Air System**

- Pneumatic tools are tools powered by compressed air at pressures of up to 90 psi. Pneumatic impact tools include riveting guns, nail guns, and chipping hammers.
- The air hose presents hazards similar to electrical cords. The hose can be a tripping hazard so it must be kept out of the way or protected. The hose must be kept clear from the work to prevent damage from the tool. If a hose gets cut and is pressurized, it can whip around and cause injury. A short length of chain attached to the tool and hose can prevent this if the hose coupling breaks.
- Care must be taken to always use hose built for the pressure involved. There have been instances where workmen have put a hand over a pinhole leak and had air forced into a finger by the high pressure.
- Control recoiling of the air hose after each use. Never let the air hose recoil rapidly on its own.
- Before disconnecting the air hose from the air line, make sure that the air pressure is off and any air pressure inside the line has been released. A safety check valve shall be installed in the air line at the manifold to shut- off the air pressure if a fracture occurs in the hose.
- Pneumatic percussion tools such as air hammers and riveting guns operate by producing heavy impacts or by rapid pulsating motion. This causes a great deal of vibration. Rubber hand grips, air cushion devices, and vibration dampers shall be used where possible.
- Air operated staplers and nailers can cause injury by the accidental firing of the fastener. The fastener can travel at very high velocity and can easily puncture tissue from a good distance. Never point a nailer or stapler at another person. Always be aware of where the fastener is going when you activate the tool.
- In the use of pneumatic chipping tools there is a hazard from flying chips. Operators should wear safety goggles.
- Noise levels from pneumatic tools are usually elevated and should be evaluated to determine if hearing protection is required. OSHA says; at 85 decibels, hearing protection should be offered to the employees, and at 90 decibels, hearing protection is required.

## **Cutting Tools**

- The main hazard associated with cutting tools is tool slippage.
- A dull tool or poor tool technique can cause a slip, which can redirect the cutting part of the tool toward the body. In addition, a sudden release or change in the force applied to a tool can throw the user off balance, possibly falling into another object which may cause injury.
- To prevent slippage, tools shall be kept sharp and handled in such a way that, if a slip occurs, the direction of force will be away from the body. In addition, cutting along the grain of a material can help prevent changes in the pressure applied to the tool, thereby preventing slippage.

## **Impact Tools**

- Impact tools include various types of hammers like riveting hammers and carpenter's claw hammers.
- The main hazard associated with all these tools is damage to the hands and arms.
- The handle shall be securely fitted and suited for the type of job and type of hammer head. The striking face of the hammer shall be kept well-dressed according to the application.
- The handle shall be smooth and free of oil to prevent slippage.
- Safety goggles shall be worn at all times when hammering to protect from flying nails, wood chips, and metal or plastic fragments.
- To properly drive a nail, hold the hammer near the end of the handle and start off with a light blow. Increase power after the nail is set.
- To avoid chipping of the hammer head, use the lightest swing possible, hammer straight and not on an angle. Inspect the head of the hammer for potential chipping.

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## **Torsion Tools**

- Torsion tools are used to grip, fasten, and turn.
- These include wrenches, pliers, screwdrivers, vises, and clamps.
- There is a variety of each type of these tools.
- Wrenches should always be pulled and not pushed. Pushing a wrench can cause a loss of control if there is a sudden release of pressure. A short, steady pull should be used rather than quick, jerky motions. Where available, use a socket wrench instead of an adjustable or open-ended wrench. Socket wrenches are generally easier to control, are more convenient, and are less likely to damage a bolt or nut. When using an adjustable wrench, the pressure should be applied to the fixed jaw.
- Pipe wrenches can easily slip on pipes or fittings, causing injury. To prevent slipping, make sure that the pipe or fitting is clean and the wrench jaws are sharp and kept clean of oil and debris.
- Pliers should never be substituted for a wrench. They do not have the same gripping power and can easily slip on a tight object. When using cutting pliers, the object being cut can fly off and cause injury. Wear safety glasses when cutting with pliers.
- Screwdrivers are often misused. They should not be used for prying, as punches, or wedges. These misuses can damage the head of the screwdriver. A dull tip can cause the screwdriver to slip. The tip must be flat at the tip and tapered for a snug fit on the screw.
- When using vises, make sure that the vise is bolted solidly to the base. When cutting material in a vise, try to cut as close to the vise as possible. This minimizes vibration. Oil vises regularly.

## **Portable Power Tools**

- Because of the mobility of portable power tools, they can easily come in contact with the operator's body.
- In addition, the source of power (electric, compressed air, liquid fuel, or explosive cartridge) is in close proximity to the operator, thus creating additional hazards.
- Typical injuries caused by portable power tools include burns, cuts, eye injury, and sprains.
- Sources of injury include electric shock, flying objects and particles, fires, falling tools, and explosion of gases.

## **Power Hand Saws**

- The main hazard associated with all saws is being cut by the blade.
- Inspect blades regularly. Make sure blades are sharp.
- Keep the saw blades clean. Buildup of material on the blade increases blade friction. This increases the chance of kickback.
- Make sure that blade guard works properly. Inspect guards frequently to make sure they rotate freely and cover the saw blade when not cutting.
- For circular saws, set the blade depth no more than 1/8 to 1/4 inch greater than the thickness of the material.
- A circular saw shall be started and stopped outside the work. Extra care should be taken at the beginning and end of the sawing stroke to keep the body and cord away from the blade.
- Don't overload the motor by pushing too hard or cutting a heavy material with an inadequate saw.
- Never cut wet wood. Kickback may occur.
- Inspect the material to be cut before cutting. Look for nails, staples, or other foreign objects that could bind the blade or fly off during cutting.

## **Hand Drills**

- The rotating drill bit can serve as a hazard in many ways:
- It can break and fly off.
- It can catch the material being worked on, causing the material to rotate freely and hit something or someone.
- The drill can slip and the user can be punctured by the bit.

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## **Hand Drills (continued)**

- To protect from these drill hazards, employ the following when using drills:
- Use the correct bit for the material. There are special bits for metal, wood, masonry, plastic and other materials.
- Make sure that drill bits are sharp. A dull bit causes the user to press harder on the drill and increases the chance of tool slippage or bit breakage.
- Old bits can get metal fatigue. Replace bits according to the manufacturer's guidelines.

## **Soldering Irons**

- The main hazards associated with soldering irons include burns and toxic fumes.
- Resting the iron on wood or metal over wood can cause fires. The use of insulated soldering iron holders reduces the fire hazard and chance of burns from accidental contact. The holders should prevent accidental touching of the iron tip.
- Make sure that there is adequate ventilation to remove soldering fumes.
- Lead is harmful if ingested. If lead solder is allowed to accumulate on floors and work surface, it can be tracked home. Keep these areas clean.

## **Glue Guns**

- Glue guns can heat glue to very high temperatures.
- Avoid contact with the tip of the glue gun and the glue itself.
- Do not lick the tip of the glue gun to see if it is hot!

## **Stationary Power Tool Safety**

- Many of the safety practices used for portable tools apply to stationary power tools.
- However, stationary tools tend to be larger, more powerful, and more complex.
- These factors can lead to serious injuries.
- Some of the safe practices which we learned in previous sections apply to stationary tools.
- Safety devices and guards must always be in place. These devices were designed by the manufacturer to be used with the tool.
- Always keep blades and cutting edges sharp!
- Perform maintenance, accessory changes, and adjustments only when the tool is off and unplugged.
- Don't wear loose fitting clothing. High-powered stationary tools can catch clothing and draw the operator's body into the tool.
- When using any type of stationary saw, never use gloves. They can get caught in the saw.
- Never put your fingers and hands in front of saw blades and other cutting tools.
- Never turn or feed the material or work piece at excessive speed. This increases stress on both the work piece and the machine.
- Because stationary tools tend to be complex, tools from different manufacturers can vary in safety and operation procedures and precautions. Read the owner's manual and safety precautions before using.
- Many stationary tools are equipped with emergency- off switches. Know the location of these switches and the tool power switch.
- Make sure that blades, bits, and accessories are properly mounted. In addition, make sure all locking handles and clamps are tight before using a tool.
- Watch for flying objects. Keep unnecessary personnel away from machines when in use.

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## Miter Saw / Sliding Compound Miter Saw / Chop Saw

- The Miter Saw (sometimes called a chop saw has become a very important tool on the job site.
- Because of its ability to cut a variety of ways, it presents a variety of hazards.
- If used properly it can be one of the safest tools in the shop.
- Remove rings, watches, and other items that might catch in the saw. Wear garments with short or tight sleeves. Wear proper eye protection.
- Be sure to use the correct cutting motion. The various types of miter saw have different requirements.
- Make sure that the stock is held firmly against the fence.
- Do not disable the blade guard.
- Make any adjustments to the saw only after the blade has stopped moving.
- Unplug the saw before changing blades.
- Support the stock to be cut along its entire length. Never cut stock that is too short to hold securely.
- Many miter saws operate with a high-pitched whine. Wear hearing protection.
- Do not lift stock into the blade.
- Make sure the saw is equipped with a blade brake. A blade brake allows the blade to be stopped quickly. This reduces the chances of hand injuries caused when blade spins freely.

## Band Saw

- Always stand to the left of the band saw. In the event of a broken blade, the blade will fly off to the right. If the blade breaks, shut- off the power and stay away from the saw until it stops.
- Care should be taken in uncoiling, removing, and installing the band saw blade. Use gloves. The blade shall be adjusted and tensioned properly.
- The blade guard is very important when using the band saw and jig saw. Keep your fingers away from exposed parts of the blade.
- Follow the manufacturer's guidelines for adjustment of the sliding bar or post. If the guide is too high, the blade will not have the proper support. It must be set at 1/8" above stock.
- Avoid backing out of the cut. This could push the blade off the wheels.
- Never cut a small radius with a wide blade unless you make relief cuts first.

## Jig Saw

- Always install the blade with the teeth pointing down. Adjust the tension according to the manufacturer's guidelines. Turn the pulley over by hand to make sure that the blade operates properly before turning on the power.
- Do not place excess force on the jigsaw blade. It can easily break and fly off.
- Adjust the blade guide and hold down properly.

## Wheel Grinders

- The chief hazards from wheel grinders are flying pieces of a shattered grinding wheel and being cut by the grinding wheel.
- Before each use, inspect the grinder to ensure that the grinding wheels are firmly attached and that the work rests are tight.
- Because some grinders can be converted to buffers, guards are often removed. When using the unit as a grinder, always have a guard in- place.
- Always inspect the grinding wheel before use. The wheel should be free of cracks. Grinding wheels shall be ring tested prior to installation.
- Too much pressure on the wheel can cause it to fracture. Spend more time at lighter pressure. Always use grinding discs that are marked with a rating speed above the maximum speed of the grinder. Never use an unmarked grinding wheel. Check the spindle speed before mounting the wheel.

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## **Drill Press**

- Many of the safety rules of the portable drill apply to the drill press. In addition, follow these rules:
- Always secure the material being drilled.
- Align drill bit to the center of the drill press table.
- When lowering the press, keep your hands out of the way of the bit.
- Never use a hand or auger bit. Use bits designed only for the drill press.
- Never try to stop the machine by taking hold of the chuck after the power is off.
- Check to make sure the chuck is secured before turning the drill press on.
- Always remove chuck key before turning on power.
- Remove chips from the table with a dust brush.

## **Disc / Belt Sander**

- Do not operate sanders without the guards in place.
- On the disc sander always use the downward motion side of the disc to sand.
- Never use the upward motion side as this can throw your part upwards with tremendous force.
- Always attempt to place your work against the rest on the disc and belt sanders.
- On the horizontal belt sander, always sand, so that the belt motion is away from you.
- Do not operate machines with torn or ripped belts or disks.
- Do not push the work against the sander surface with excessive force as this may cause it to be thrown.
- Always** wear eye protection.

## **Oscillating Spindle Sander**

- Be aware of the spindle rotation when sanding.
- Keep fingertips away from the moving spindle. Serious injury could result if skin contracts abrasives or moving parts.
- Never use excessive force when sanding. Doing this greatly increases the chances of personal injury and motor overload.
- Always feed the work against the direction of rotation.
- If there is any doubt as to the stability or integrity of the materials to be sanded, don't sand it.
- Do not operate sander with a damaged or badly worn sanding sleeve.
- Tie back long hair and remove any loose-fitting clothing or jewelry that could be caught up in the sander's spindle or other moving machine parts.

## **Bending Machine (Brake Only)**

- Though the bender is powered by human force alone, the long push arm, counterweight can generate a great deal of force.
- If body parts get caught in the brake, they can be easily broken or cut- off.
- Never place any body part in the blade area.
- Always check the work area around the brake. Be sure that the area is free of people and debris.
- Before using the brake, check the counterweight rods and counterweights to make sure they are secure.
- Never place material in the brake which is too rigid for the capacity of the brake. Overstraining the brake can cause the arm and other parts to break and possibly cause injury.

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### **Brake, Shear and Roll**

- This Brake, shear and roll is designed and intended for use by properly trained and experienced personnel only.
- Use caution while loading and unloading machine as there may be sharp edges and burrs.
- Keep hands and fingers clear of the area in front of and rear of the shearing blades,
- Keep guards in place when not using slip roll.
- Keep other people away from machine while you are using it.
- Do not exceed the maximum capacity of the machine.

### **Sheet Metals Shears**

- Keep fingers away from the cutting blade.
- Wear leather gloves when handling sheet metal to avoid cuts from sharp edges.

### **Milling Machine**

- Many of the general safety rules of the drill press apply to the milling machine.
- Always secure the material being milled.
- Become familiar with the direction of the axis tables before operation.
- Become familiar with the forward and reverse electrical start button.
- When raising the mill, keep your hands out of the way of the bit.
- Use only mill bits designed only for milling operations.
- Never try to stop the machine by taking hold of the chuck after the power is off.
- Check to make sure the collets are secured before turning the mill on.
- If using a drill chuck always remove key before turning on power.
- Be aware of the mill bit and table vise clearance.
- Make sure brake is off before the start-up of the motor.
- Do not force table movement without proper adjustments.
- Always disconnect power before making any adjustments or servicing.
- Never leave the tool unattended.
- Do not place hands near the cutter head while the machine is operating.
- Be sure that the work and cutter are mounted securely before taking a cut.
- When mounting or removing milling cutters, use a rag to avoid getting cut.
- Never attempt to make any adjustments or measurements to the work piece set-up until the milling machine is completely stopped.
- Keep hands, brushes, and rags away from the milling cutter at all times.
- Do not attempt to remove too much material in one pass.
- Always use a brush to clean the work and machine, never compressed air nor a rag.
- Never move your hands near to a revolving cutter. The only guard on this machine is your brain.
- Keep the work area clean of oil and metal chips, as well as tools.

### **Metal Lathe**

- Keep hands and fingers well away from the cutter tool.
- Check that the cutter is tight in the chuck. Use the proper Allen wrench.
- Keep the work area clean and clear of tools and debris.
- Check that the spindle lock is removed before operating the machine.
- Do not attempt to remove too much material at one pass. Use only soft materials for work pieces.
- Know where the Emergency Stop button is located.
- Make sure that the work piece is secure in the chuck.

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### **Metal Lathe (continued)**

- Make sure that the work piece size is within the limits of your lathe.
- Replace wooden block rest under the cutter head before shutting off the power.
- Always use a brush to clean the work and machine, never compressed air or a rag.
- Never move your hands near to a revolving cutter. The only guard on this machine is your brain.
- Keep the work area clean of oil and metal chips, as well as tools.

### **Metal Band Saw - Horizontal**

- The blade guard is very important when using the band saw and jig saw. Keep your fingers away from exposed parts of the blade.
- Follow the manufacturer's guidelines for adjustment of the sliding bar or post.
- Avoid backing out of the cut. If the blade has to be backed out of the cut, do so with the machine still running.
- Never stop the band saw while the blade is in a cut.
- Know the feed and speed rate for cutting different types of metals
- Use coolant to maintain proper cooling of material during cutting operation.
- Know where the Emergency Stop button is located.
- Make sure that the work piece is secure in the vice.
- Make sure that the work piece size is within the limits of your metal band saw.
- Always use a brush to clean the work and machine, never compressed air or a rag.

### **Welding (MIG or TIG)**

- Only qualified personnel should operate, maintain and repair this equipment.
- During operation, keep everybody away and outside of yellow welding safety curtain.
- Wear an approved welding helmet fitted with proper shade of filter lenses.
- Wear dry, hole free insulating gloves and body protection.
- Use protective screens or barriers to protect from flash, glare and sparks, warn others not to watch the arc. The arc is brighter than the sun and permanent eye damage may occur if you look directly at the arc.
- Do not weld in wet areas.
- Properly install, ground, and operate this equipment according to its Owner's Manual and national, state and local codes.
- Turn off all equipment when not in use.
- Do not touch electrode if you are in contact with the work, ground, or another electrode from a different machine.
- Do not touch hot parts with your bare hands.
- Allow cooling period before working on equipment or material.
- To handle hot parts, use proper tools and/or wear heavy, insulated welding gloves and clothing to prevent burns.
- Keep your head out of the fumes. Do not breathe the fumes.
- If inside, ventilate the area and/or use local forced ventilation at the arc to remove welding fumes.
- If ventilation is poor, wear an approved air-supplied respirator.
- Do not weld in locations near degreasers, cleaners, or spraying operations. Welding can cause fire or explosions.
- Welding, chipping, wire brushing and grinding can cause sparks and flying metal. As welds cool, they can throw off slag.

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## CNC Plasma Cutter

- Electric Shock Can Kill.
- Operating a plasma cutter completes an electric circuit between the torch and the work piece. The work piece and anything touching the work piece are part of the electrical circuit.
- Never touch the torch body, work piece or the water in a water table when the plasma system is operating.
- Plasma cutter output voltages are much greater than other machines.
- Do not pick up the work piece, including the waste cutoff, while you cut. Leave the work piece in place on the workbench with the work cable attached during the cutting process.
- During plasma cutting operations do not move the work clamp.
- Wear insulated gloves and boots, and keep your body and clothing dry.
- Do not stand, sit or lie on or otherwise touch any wet surface when using the plasma cutter system.
- Insulate yourself from work and ground using dry insulating mats or covers big enough to prevent any physical contact with the work or ground. If you must work in or near a damp area, use extreme caution.
- Ensure metal-to-metal contact between work cable and work piece or work table.
- Work cable clamp should make contact with clean metal free of rust, dirt, painted surfaces, etc.
- Plasma cutter arc rays produce intense visible and invisible (ultraviolet and infrared) rays that can burn eyes and skin.
- Wear gauntlet gloves, safety shoes and hat.
- Wear flame-retardant clothing to cover all exposed areas.
- Wear cuff less trousers to prevent entry of sparks and slag.
- Remove combustibles, such as a butane lighter or matches, from your pockets before cutting.
- Plasma arc cutting systems can generate noise levels in excess of 120 dB during high-amperage cutting operations.
- Ear protection should be used when operating or working near plasma arc cutting operations.
- Plasma arc cutting can produce toxic fumes and gases that deplete oxygen and cause serious injury.
- Keep the cutting area well ventilated or use an approved air-supplied respirator.
- Do not cut in locations near degreasing, cleaning or spraying operations. The vapors from certain chlorinated solvents decompose to form phosgene gas when exposed to ultraviolet radiation.
- By paying attention to safety standards and correctly setting up and operating the system, plasma arc cutting poses no more a threat than most welding processes. The plasma arc cutting process can be very safe.

## Tube / Pipe Bender

- Always read and understand directions that are included with the tube / pipe bender equipment before operating.
- Use of tube / pipe bending equipment may present a pinch and crush hazard.
- Always operate tube / pipe bender equipment wearing safety protection.
- Always use the correct dies for the project.
- Never use pipe bending dies on a tube or tube dies on a pipe.
- Know the materials you are using before beginning fabrication.
- Always inspect equipment prior to use to make sure it is in good working order. If you are in doubt, do not use and ask instructor for proper training.
- Never substitute components from other equipment. Make sure components match.
- Never exceed the manufacturer's specifications.

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## Sand Blasting Cabinet

- Read and understand owner's manual BEFORE using machine. Untrained users can be seriously hurt.
- Always wear ANSI-approved safety glasses or face shield when operating or observing sand blaster to reduce the risk of eye injury or blindness from flying particles. Everyday eyeglasses are not approved safety glasses.
- Dust created while using machinery may cause cancer, birth defects, or long term respiratory damage.
- Do not wear clothing, apparel, or jewelry that can become entangled in moving parts. Always tie back or cover long hair. Wear non-slip footwear to avoid accidental slips which could cause a loss of work piece control.
- Never use wet abrasives in this sandblaster; it is designed for dry abrasives only.
- Always disconnect air supply when leaving the sandblaster.
- Always close the latch shut the sandblaster doors when not in use or before sandblasting begins.
- Prior to each use, inspect nozzles, hoses, lenses, and gloves.
- Do not use system over the rated PSI.
- Always secure the door(s) before beginning sandblasting operations.

## Pneumatic Lift

- Loads must be centered on table at all times.
- Load must not exceed 1000 lbs. maximum.
- Connect to 100 PSI maximum shop air.
- Loads must be firmly clamped, strapped and/or chocked in positioned on the table at all times.
- Never place hands near pinch points when opening and closing lift.
- Always check load bar before adding weight to lift.

## All Vises

- A vise, sometimes called the third hand, is an indispensable tool in the tool room or workshop. Vises are usually mounted on workbenches or similar firm supports to hold material in place.
- Most vises can be used for a wide variety of work. Select the most suitable vise which is strong enough for the work.
- Always keep vises closed, but loose, when not in use and the handles in a vertical position.
- Before operation ensure that the workbench vise is firmly secured to its base.
- Check the vise for cracks or other damage before clamping a work piece in it.
- Use a vise large enough to hold the work without strain.
- Place the work piece in the vise so that the full clamping surface of the jaw supports the work piece
- Keep the work piece in the vise close as possible to the jaws to prevent vibration when sawing and filing, etc.
- Support the end of extra-long work with an adjustable stand, saw horse, or box rather than putting extra strain on the vise.
- Keep all threaded and moving parts clean, oiled and free of chips and dirt.
- Use jaw liners in a vise where there is any possibility of marking the work.
- Replace a bent handle and worn jaw inserts.
- Do not cut into the jaws.
- Do not apply heavy pressure at the corner of the vise jaws.
- Do not use a handle extension (e.g., a pipe) for extra clamping pressure.
- Do not hammer on the handle to tighten beyond hand pressure.
- Do not use the jaws of the vise as an anvil.
- Do not use any vise that has the slightest crack. Inform instructor immediately.
- Do not unscrew or open the jaws of the vise wider than they were designed to be used.

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## Hydraulic Tools and Jacks

- The fluid used in hydraulic power tools must be an approved fire resistant fluid and must retain its operating characteristics at the most extreme temperatures to which it will be exposed.
- The manufacturer's recommended safe operating pressure for hoses, valves, pipes, filters, and other fittings must not be exceeded.
- All jacks—including lever and ratchet jacks, arbor presses, screw jacks, and hydraulic jacks—must have a stop indicator, and the stop limit must not be exceeded. Also, the manufacturer's load limit must be permanently marked in a prominent place on the jack, and the load limit must not be exceeded.
- A jack should never be used to support a lifted load. Once the load has been lifted, it must immediately be blocked up. Put a block under the base of the jack when the foundation is not firm, and place a block between the jack cap and load if the cap might slip.
- To set up a jack, make certain of the following:
  - The base of the jack rests on a firm, level surface;
  - The jack is correctly centered;
  - The jack head bears against a level surface; and
  - The lift force is applied evenly.
- Proper maintenance of jacks is essential for safety. All jacks must be lubricated regularly.
- Each jack must be inspected according to the following schedule: (1) for jacks used continuously or intermittently at one site—inspected at least once every 6 months, (2) for jacks sent out of the shop for special work—inspected when sent out and inspected when returned, and (3) for jacks subjected to abnormal loads or shock—inspected before use and immediately thereafter.

## Overhead Chain Hoist

- Loads should not be suspended over personnel below.
- People in the direction of travel should be warned to move and remain clear of a lifted load at all times.
- Directional crane movement should be made smoothly and deliberately. Avoid rapid movements in any direction.
- Under no circumstances may anyone ride the hook or load.
- Do not operate a crane or hoist if limit switches, steel ropes, chains or other components are worn or in disrepair.
- Never operate a hoist that has been tagged with an "Out of Order" or "Do Not Operate" tag.
- Never pull a hoist by the pendant (hanging) power cable.
- If loss of electrical power occurs, place controls in the "OFF" position to prevent unexpected startup upon restoration of power.
- Hoist operators must inspect equipment daily before use.
- Control buttons should be labeled to indicate their function.
- Know the location of disconnect switch that will cut the power off only to the hoist or crane. Be sure that the disconnect switch is readily accessible and not blocked.
- Check for any loose or missing parts.
- Operate each control button to make sure it functions properly, releases immediately, and does not stick.
- Check all hooks.
- Hooks should not be cracked, stretched, bent, or twisted.
- Each hook must have a safety latch that automatically closes the throat of the hook.
- Check the condition and capacity of the chain, hooks, nylon or synthetic web slings.
- Report any unsafe conditions immediately.

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## **Garage Doors**

- Remember a garage door and garage door openers are not toys and should not be played with. Serious injury or death can result from misuse.
- Never play with a garage door opener or operating system, stand, run or play under or near a garage door, especially while the door is moving.
- Never try to enter or exit the garage by racing under a moving garage door.
- Keep hands and feet away from door sections when the door is opening or closing to avoid injury.
- Always keep the garage door in view when opening or closing to make sure that there are no people standing in the way of the door or trying to enter or exit while the door is moving.
- Do not leave the garage door partially opened because when activated again it may travel downward and come in contact with an object or person in its path.
- Never attempt to repair a garage door's springs or cables without a trained service technician. The cables and springs are under extreme tension and can cause severe injury or death.
- Keep your garage door and operating system properly maintained for safety. Annual maintenance by a trained service technician is recommended.

## **Hazardous Spills**

- Never siphon any chemicals (even water) by mouth.
- Never work alone in the fabrication lab with chemicals in case of spillage or leakage.
- Wear the required Personal Protection Equipment (PPE) in the lab at all times when using chemicals in case of spillage or leakage.
- The fabrication lab floor must always be kept dry, clean, and uncluttered. Any spills must be cleaned up immediately. Any major spills must be reported immediately.
- For a major spill, call 911
- Clean up any spills with paper towels or adsorbent clay. Ask the T A for assistance.
- Any accident or hazardous situation must be reported to the instructor immediately.
- Wash hands after using all chemicals and also before leaving the lab.
- Students should consult the instructor whenever there is some question regarding the safe use of chemicals.

## **Welding Gasses and Tanks - Oxygen, Acetylene and Argon**

- Compressed gas cylinders contain gas under high pressure. If damaged, a cylinder can explode. Since gas cylinders are normally part of the welding process, be sure to treat them carefully.
- Protect compressed gas cylinders from excessive heat, mechanical shocks, physical damage, slag, open flames sparks and arcs.
- Install cylinders in an upright position by securing to a stationary support or cylinder rack to prevent from falling or tipping.
- Keep cylinders away from any welding or other electrical circuits.
- Never drape a welding torch over a gas cylinder.
- Never allow a welding electrode to touch cylinder.
- Use only correct compressed gas cylinders, regulators, hoses and fittings designed for the specific application; maintain them and associated parts in good condition.
- Turn face away from valve outlet when operating cylinder valve.
- Keep protective cap in place over valve except when cylinder is in use or connected for use.
- Use the right equipment, correct procedures, and sufficient number of persons to lift and move cylinders.
- Read and follow instructions on compressed gas cylinders, associated equipment and Compressed Gas Association (CGA) publication P-1 listed in Safety Standards.

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## **Spray Booth Operation**

- Students who are expected to use spray operations equipment shall be trained by their instructor in the safe handling and proper use of all equipment and materials associated with paint spray operations, prior to their use. The student shall also be oriented to the location(s) and proper use of all emergency, safety, and PPE they may be required to use in their work performance.
- Paint spray operations may present both health and physical hazards from the chemicals contained within the paint or applied material.
- Potential health hazards include exposure to solid and liquid aerosols as well as to organic solvents and their vapors through inhalation or dermal absorption. Skin contact may also cause dermatitis and localized skin irritation. Inhalation and absorption of organic solvent and vapors often results in central nervous system (CNS) disorders. Some paint pigments and additives are highly toxic, such as lead, cadmium and chromium.
- Exposure to flammable/combustible or explosive paint spray mists, particulates and vapors, as well as accumulated paint spray residues.
- Pressure equipment used in painting operations may be hazardous because of its compressed air component.
- Students engaged in paint spray operations shall review applicable Material Safety Data Sheets (MSDS's) prior to work, in order to understand the properties and hazards of the solvents in use and their safety precautions.
- Spray booths shall be separated from other operations by at least three feet or by a 1-hour rated fire wall.
- There shall be no open flame or spark producing equipment in any spraying area or within 20 feet unless separated by an approved partition.
- Ventilation system must be turned on before any spray booth operations start and shall be operated continuously during paint spray operations and for a sufficient time after paint spray operations have stopped in order to allow vapors from drying coated articles and drying finishing material residue to be completely exhausted. Adequate conditioned make-up air shall be provided.

## **Paint Spraying (Spray Gun or Rattle Can)**

- Never point a paint spray gun or rattle can at any part of the body. Paint can be hypodermically injected into the body by high operating pressures.
- Do not disconnect the gun from the fluid hose or the hose from the pump until the pressure has been released from the hose. Close off the main line air pressure to the pump, and then bleed off the pressure in the fluid hose by triggering the gun before disconnecting it.
- When handling the spray gun (e.g., while changing parts or work positions), hold the gun by the grip and remove your fingers from the trigger, which will prevent the gun from being inadvertently activated. Paint spray guns shall be equipped with trigger guards and a safety lock. The lock must be in the non-operating position except when the gun is in use.
- When using the spray gun check all hose connections and fittings to make sure they are tight and not leaking.
- Never pass a finger over the spray gun or rattle can orifice to clean it; hypodermic injection of paint into your finger may result. Consult the manufacturer's operating manual for cleaning procedures.
- All spray items to be painted shall be grounded to prevent static electricity from being created. Periodic continuity checks shall be performed to ensure the ground wire remains intact.
- Do not stand downwind of the object being sprayed. A turntable or similar device shall be used to facilitate access to all sides of an object without placing the worker between the object and the exhaust filters.
- To prevent the accumulation of explosive vapors, or the release of toxic vapors into the work area outside of the spray operation, freshly painted items shall be dried in the spray booth or spray area with its exhaust ventilation operating.
- Personnel must change clothing if it becomes contaminated with paint spray chemicals in order to minimize skin contact. Students' clothing shall not be left on the premises overnight unless kept in metal lockers.
- Cleaning. Paint spray operation areas shall be cleaned daily to remove the accumulation of deposits of combustible residues. Cleaning tools shall be made of non-sparking material.

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## Storage and Handling of Hazardous, Flammable and Combustible Chemicals or Materials.

- The quantity of paints, lacquers, thinners, solvents, and other flammable and combustible liquids kept near daily operations shall be the minimum required for one day's operations. The quantity of these materials shall not exceed a one-day supply.
- Portable containers of flammable/combustible liquids shall be stored in a separate building, in approved flammable liquid storage cabinets, or in a flammable liquid storage room that meets the requirements of NFPA 30, Flammable and Combustible Liquids Code.
- Flammable/combustible liquids shall be stored in approved fire-resistant safety containers equipped with flash screens and self-closing lids.
- Storage of open containers shall be prohibited. Open containers may only be used to clean materials, and then the solvent must be transferred back to a closed container for storage or disposal.
- Storage of compressors, hoses, pressure tanks, and pneumatic tools shall be in areas designated by the instructor and the organizational Safety Coordinator.
- Pressurized aerosol paint spray cans are flammable materials and they shall be stored in the same manner as other flammable paint materials.
- The withdrawal and filling of flammable/combustible liquids from containers, including portable mixing tanks, shall be done only in a mixing room and/or a spraying area when the ventilating system is in operation.
- Precautions shall be taken to protect against liquid spillage and sources of ignition.
- Good housekeeping is essential to safe operations in all fabrication lab areas. The fabrication lab including storage rooms paint booths, etc., shall be kept clean, and equipment shall be stored in an orderly manner.
- All overspray residue, scrapings, discarded filter pads and rolls, and other paint-related debris and flammable material shall be immediately removed and disposed of properly. Rags and waste shall be placed in approved self-closing metal containers that are plainly marked to indicate the contents. At the end of each day these containers shall be emptied or removed to an approved location for pick-up and disposal.

### Summary

Remember these important points when working in the fabrication lab:

- Make sure that equipment is maintained properly. A mis-adjusted tool or a tool in poor condition can be hazardous.
- Don't be afraid to admit that you don't know how to use a tool. To learn about tool use talk to your instructor or supervisor, read the tool manual and craftsmen literature.
- Respect the tool power source. Whether the power source is electric, pneumatic, or fuel driven.
- Always keep your fabrication lab in good "working order".
- Always wear your **safety glasses**.

### Safety Plan

- In the event of an emergency turn off the red power button located on each wall.
- Stay calm. Alert the instructor and "Call OUT" if needed.
- Have student sit or lay down according to the injury and stay with them.
- If injury is serious, one student will go to main office to alert administration.
- Instructor will call 911 from the fabrication lab as required

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# **Student & Parent Safety Agreement Contract**

**Safety Test Title:** General Student Safety Test for Design Technology

**School:** Dakota High School – 21051 21 Mile Road – Macomb, MI 48044

**Instructors:** Mr. Allan E. Kobler Phone: (586) 723-2857 Email: [akobler@cvs.k12.mi.us](mailto:akobler@cvs.k12.mi.us)  
Mr. Scott E. Mitchell Phone: (586) 723-2856 Email: [smitchell@cvs.k12.mi.us](mailto:smitchell@cvs.k12.mi.us)

**School Year:** 2014 – 2015

Please sign below if you agree to the safety precautions listed in the following:

- Student will follow all safety rules demonstrated, displayed, tested on and featured in the fabrication lab. All students in the fabrication lab will follow the rules set forth by the Chippewa Valley Schools “Code of Conduct”.
- Student must pass the safety test with a 90% correct or higher. If the student does not pass the safety test, the same test will be administered in its entirety after a review of all safety procedures. The student and parent understand that this is a requirement in order to work in our fabrication lab. Note: The safety test must be taken and passed before the student will be allowed to work in our fabrication lab.
- Student agrees to and understands the importance of safety in school and in a fabrication lab type environment. It is expected that the behavior of the student is responsible, safe and respectful of all workplace safety precautions. Students who are not safe create an unsafe work environment for all those present in the fabrication lab and will be removed instantly. The school will provide a safe classroom environment, but it is the students and instructors working together that will provide the safest fabrication lab environment possible.
- The student is capable of working in a fabrication lab type classroom environment with no handicaps that would create an unsafe situation for themselves or other classmates. The student is capable of working with power tools, machines and equipment as instructed by the teacher. If there are any special circumstances, physical or otherwise, that could impact the student’s safety or others in the fabrication lab classroom, please contact the teacher directly.
- I understand by signing below that any student acting in an unsafe manner will lose fabrication lab privileges and be removed from the class.

Student Name: \_\_\_\_\_  
(Please Print)

Student Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Parent Name: \_\_\_\_\_  
(Please Print)

Parent Signature: \_\_\_\_\_

Date: \_\_\_\_\_