

# California Institute of Technology

## SHOP SAFETY PROGRAM

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## **Introduction**

Caltech has developed this Shop Safety Program to manage the hazards associated with various shops. Employees working in shop areas have a responsibility to know the equipment they are working with, work with the equipment in a safe manner, and immediately report problems encountered with the equipment to their Supervisor.

This Program will review general safety precautions and procedures for powered and non-powered tools and equipment.

## **General Safety Precautions**

Employees who use hand and power tools and who are exposed to the hazards of falling, flying, abrasive and splashing objects, or exposed to harmful dusts, fumes, mists, vapors, or gases will be provided with the particular personal equipment necessary to protect them from the hazard.

Hazards involved in the use of power tools can be prevented by following five basic safety rules:

1. Keep all tools in good condition with regular maintenance.
2. Use the right tool for the job.
3. Examine each tool for damage before use.
4. Operate according to the manufacturer's instructions.
5. Provide and use the proper personal protective equipment.

## **Personal Protective Equipment**

**Safety Glasses** are available to employees performing tasks in which there is a chance of injury involving the eyes. Prescription safety glasses are available to employees with a current eyewear prescription card. Always wear safety glasses when conditions require them.

**Hearing protection**, including plugs and muffs, should be worn in noisy environments. The Environment, Health, and Safety Office (EHS) performs periodic evaluations of areas that may fall under the Institute's [Hearing Conservation Program](#). For more information, check with your Supervisor or call EHS.

**Sturdy shoes** with slip resistant soles should be worn. If your work exposes you to possible foot injuries, wear steel toed shoes.

**Short-sleeved shirts** should be worn whenever possible. Do not wear loose fitting long sleeves.

## **General Safety Procedures**

- When lifting materials, do not attempt to lift with your back. Keep heavy materials close and maintain a sturdy posture.
- Stop the job whenever a signal of an electrical danger is received. Signals include shock or tingling sensations, exposed wires, sparks, smoke, and burning odors.
- Wash thoroughly after contacting solvents and lubricants.
- Never reach around a guard while the machine is still in motion.

- Do not start equipment if a cutting tool is in contact with a work piece.
- Do not touch chips with your bare hands.
- Clean up the work area periodically throughout the day and at end of day before leaving the site.

### **Tips for Working with power Tools**

- Switch all tools OFF before connecting them to a power supply.
- Disconnect and lockout the power supply before completing any maintenance work tasks or making adjustments.
- Ensure tools are properly grounded or double-insulated. The grounded equipment must have an approved 3-wire cord with a 3-prong plug. This plug should be plugged in a properly grounded 3-pole outlet.
- Test all tools for effective grounding with a continuity tester or a Ground Fault Circuit Interrupter (GFCI) before use.
- Do not bypass the on/off switch and operate the tools by connecting and disconnecting the power cord.
- Do not use electrical equipment in wet conditions or damp locations unless the equipment is connected to a GFCI.
- Do not clean tools with flammable or toxic solvents.
- Do not operate tools in an area containing explosive vapours or gases, unless they are intrinsically safe and only if you follow the manufacturer's guidelines.

### **Hand Tools**

Hand tools are non-powered equipment including hammers, hacksaws, pliers, and wrenches. Many injuries involving hand tools result from their improper maintenance and use.

- Do not use hammers that have broken handles or loose heads.
- While chipping, chip in a direction where the flying chips will not do harm. Always wear safety eyewear when chipping.

### **Machine Tools**

- Do not remove safeguards.
- Machinery should be anchored to the floor or table to prevent tipping over.
- There should be a power shutoff switch within reach of the operator.
- Shut down machinery for cleaning and maintenance.
  - Disconnect the machine or follow the Caltech [Lockout/Tagout Program](#).
- Keep transparent guards clean.
- Keep fingers clear of the point-of-operation on mechanical equipment by utilizing push sticks, hooks, or other special protective tools or devices.
- Do not stand directly in-line with work being fed into circular saws, joiners, or wood shapers.
- Maintain precaution around revolving shafts.
  - Do not wear loose clothing, jewelry, or long hair around such machinery.
- Wear safety goggles whenever there is exposure to flying chips, particles, liquids, chemicals or sparks that may cause injury.
- Ground all power tools.

## Abrasive Wheels

- Grinding wheels should have tool rests that hold the work firmly. Adjust the tool rest to a maximum opening of 1/8" from the wheel. The tongue should be no more than 1/4" from the wheel.
- Wear face shields when grinding.
- Do not grind on the side of a grinding wheel unless it has been specially designed for that purpose.
- Inspect new abrasive wheels before using.
- Exhaust ventilation is required when grinding large articles, prolonged grinding, grinding of potentially toxic materials, and cutting of wheels.
- Do not use cracked, broken, unbalanced, or otherwise defective abrasive wheels.
- Do not reuse discarded abrasive wheels.
- Abrasive wheels must have cover guards.

## Lathes

- Make sure all guards are in place.
- Never leave chuck wrenches in the chucks.
- Keep hands off chuck rims when operating lathes.
- Properly adjust steady rests to the operation.
- Never attempt to adjust a tool while the lathe is operating.
- Use a brush to remove chips.

## Welding, Cutting, and Brazing

- Post signs reading "DANGER – NO SMOKING, MATCHES, OR OPEN FLAMES".
- Welding is to be performed only by qualified welders.
- Always stand to one side and away from gauge faces and front of the regulator when opening the cylinder valve.
- Never open an acetylene cylinder valve more than one-half (1/2) turn. Always keep the key on the acetylene cylinder valve. In case of flashback or fire from a leaky cylinder connection. A gloved hand can withstand the heat long enough to close the valve.
- Keep fire extinguishers available for instant use.
  - Assign fire watchers to welding operations where a serious fire might develop.
  - Never use acetylene from a cylinder in a horizontal position. In this position, acetone is drawn out of the cylinder with acetylene.
  - Use the cylinder valve, not the regulator, to turn the gas off. The regulator is not a shutoff valve.
  - Do not watch the electric arc without proper eye protection. Eye protection helmets, hand shields, and goggles meeting the appropriate standards are required.
  - The following base metals, fluxes, coatings, platings, or filler metals require local exhaust ventilation:
    - Beryllium
    - cadmium
    - chromium
    - fluorides
    - lead
    - mercury
    - zinc
    - inert gas welding
    - Oxygen cutting of stainless steel

NOTE: Silver soldering also requires local exhaust ventilation due to cadmium in the solder.

## **Drill Presses**

- Clamp materials to the drill table before starting the machine.
- Tighten the chuck and remove the key before starting the machine.
- Do not force or feed too fast. Broken drills can cause serious injury.
- If the work slips stop the machine before making adjustments. Do not attempt to stop a move piece with your hands.
- Do not force drill presses by exerting excess pressure on the feed lever.

## **Ladders and Scaffolds**

- Be careful where you locate a ladder. The feel should be one-fourth of its length away from the wall it is leaning against. Ladders should have solid footing.
- Make sure the ladder is the proper size for the job. Do not stand on the top three rungs of a ladder.
- Use tool holders, including tool belts, to prevent tools from falling off the top of ladders.
- Always face the ladder when ascending or descending.
- Never use a broken ladder
- Use a wood or fiberglass ladder when working near power lines, electrical equipment, or when changing light bulbs.
- Do not use ladders in a strong wind.
- Erect barricades or guards when setting up ladders in traffic areas.
- Do not reach or lean too far to one side. Keep your belt buckle inside the ladder rails at all times.
- Scaffold must be capable of supporting at least four times the maximum intended load.
- Scaffolds must have access ladders or some other equivalent safe access provided.
  - Eliminate slippery conditions on scaffolds when discovered.

## **Woodworking Machines**

- Saws used for ripping should have anti-kick back devices and spreaders.
- Keep saws sharpened. Dull saws retard speed and may break.
- Do not use ripsaws for crosscutting. Do not use crosscutting saws for ripping.
- Check planer, shaper, joiner, knives, bolts, clamps, and guards.
- Always stop a machine before leaving it.
- Radial arm saws should be arranged so that the cutting head will gently return to the back of the table when released.