California Institute of Technology

Hand and Portable Power Tool Safety Guide

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Purpose

The purpose of this *Hand and Portable Power Tool Safety Guide* is to mitigate risk of injury to Caltech employees working with hand and portable power tools and equipment. This guide is intended to comply with the Cal/OSHA Standards contained in Title 8, California Code of Regulations.

Regulatory Reference

Cal/OSHA Title 8, California Code of Regulations, Subchapter 7, General Industry Safety Orders, Group 3, General Plant Equipment and Special Operations Article 20, ***Hand and Portable Powered Tools and Equipment*.**

Scope

This *Hand and Portable Power Tool Safety Guide* applies to Caltech employees who may use hand and portable powered tools and equipment during their course of work. The guide covers basic safety procedures and safeguards associated with hand and portable powered tools.

The Plan applies to, but is not limited, to:

- Hand-held tools and portable equipment with point-of-operation hazards or physical defects such as broken handles, mushroomed heads, or dull edges that may cause an injury to the user.
- Knives, axes, shovels, hammers, chisels, and paper cutters.
- Portable power tools supplied by energy (e.g., electric, pneumatic, hydraulic, powder-actuated, explosive-actuated, and compressed air).
- Lawnmowers and jacks.

Responsibilities

Caltech will protect its employees from hazards related to hand and portable power tools and equipment through engineering controls, tool safeguards, communication of hazards and solutions, employee training, and personal protective equipment (PPE).

Environmental Health and Safety (EH&S)

Environmental Health and Safety is responsible for:

- Maintaining, reviewing, and updating this guide as necessary.
- Aiding supervisors with identifying hazardous conditions in regard to hand and power tools.

Supervisor

Department supervisors are responsible for:

- Ensuring that all affected employees have been trained and comply with this Guide.

- Ensuring that all hand and portable powered tool equipment used are free from defects and are maintained properly.
- Ensuring employees are trained to use tools properly and in accordance with the manufacturer's instructions.
- Providing employee training in the proper inspection, use, and maintenance of each tool.
- Providing on-the-job (OTJ) training if the employee is not familiar with the equipment; and
- Removing defective hand or portable power tools from service.

Employees

All employees who use hand and portable power tools will:

- Anticipate work hazards.
- Understand and follow the hand and power tool safety procedures in this guide.
- Follow safety guidelines for the use of hand/power tools according to manufacturer's instructions.
- Inspect hand and portable powered tools and equipment for defects or possible hazards prior to use.
- Tag any defective tools as out of service immediately.
- Report any defects to your supervisor immediately.
- Refrain from using damaged hand or portable power tools.
- Use the right tool for the job.
- Not tamper with or remove safety guards.

Definitions

Hand tool	A tool that is non-powered or operates only through physical exertion by hand (e.g., axes, screwdrivers, wrenches, pliers, tin snips, and paper-cutting boards in offices.) This list is non-exhaustive.
Point of operation	The area of a tool where the work is performed, which may expose the employee to injury if defective or not properly guarded.
Portable power tool	A portable tool that requires a power source to operate, such as electric, pneumatic, liquid fuel, hydraulic, explosive-actuated, and powder-actuated device or power supply. Examples of regulated portable power tools are portable abrasive wheels and grinders, lawn mowers, powered drills, portable circular saws, portable belt sanding machines, explosive-actuated fastening tools, jacks, and abrasive blast cleaning nozzles. This list is non-exhaustive.

Safety Guard	A device or guard attached to the muzzle end of the tool, which is designed to confine flying particles. A part or assembly to prevent accidental contact with hazardous machine parts or to protect people from other hazards created by the machinery.
Personal Protective Equipment (PPE)	Refers to items typically worn by a worker to provide protection from recognized hazards. Depending on the job task to be performed, PPE generally includes safety glasses, gloves, hard hats, and safety shoes. This list is non-exhaustive.

Training

Employees should be trained in the proper use and handling of tools and equipment. General tool training should include:

- Potential hazards from using hand and power tools.
- Operate tools correctly/according to the manufacturers' instructions.
- Examine each tool for damage before use.
- Do not use damaged tools.
- Personal protective equipment to protect them from potential hazards.

General Safety Requirements

Personal Protective Equipment (PPE)

Employees using hand and power tools may be exposed to falling, flying, abrasive and splashing objects, or dust, and should be fitted with the appropriate PPE necessary to protect them from hazards.

Hearing Protection

Hearing protection is recommended when using power tools.

Tool Maintenance

All hand tool and portable power tools and similar equipment shall be maintained regularly and kept in a safe working condition.

- Only authorized employees should be allowed to repair tools.
- All repaired tools should be thoroughly inspected before they are put back into use.

Hand Tools

The greatest hazards posed by hand tools result from misuse and improper maintenance.

Some examples include the following:

- If a chisel is used as a screwdriver, the tip of the chisel may break and fly off, hitting the user or other people nearby.
- If a wooden handle on a tool, such as a hammer or an axe, is loose, splintered, or cracked, the head of the tool may fly off and strike the user or other people nearby.
- If the jaws of a wrench are stripped, the wrench might slip.
- If impact tools such as chisels, wedges, or drift pins have mushroomed heads, the heads might shatter on impact, sending sharp fragments flying toward the user or other employees nearby.

Hand Tool precautions include the following:

- Use the right tool for the job.
- Saw blades, knives, and other sharp tools are to be directed away from aisle areas and other employees working in close proximity.
- Knives and scissors will be kept sharp; dull tools can be more hazardous than sharp ones.
- Only spark-resistant tools made from brass, plastic, aluminum, or wood will be used around flammable substances.
- Wrenches, including adjustable, pipe, box-end, and socket-style wrenches, will not be used when the jaws or socket are stripped or sprung in such a way that slippage occurs or may occur.
- Impact tools such as drill pins or punches, wedges, and chisels will be kept free of mushroomed heads.
- Wooden-handled tools will be kept free of cracks and splinters and will be kept tightly attached to the working end of the tool.
- Tools will be stored in appropriate storage areas when not in use.

Portable Power Tools

Power tools can be hazardous if used improperly.

The following are examples of portable power tools. This list is non-exhaustive.

- Portable abrasive wheels and grinders
- Lawn mowers
- Powered drills
- Portable circular saws
- Portable belt sanding machines
- Explosive-actuated fastening tools
- Jacks
- Abrasive blast cleaning nozzles

Portable Power Tool precautions include the following:

To prevent hazards associated with the use of portable power tools, workers should observe the following general precautions:

- Read the owner's manual to understand the tool's proper applications, limitations, operation, and hazards.
- Use the right tool for the job.
- Inspect tools prior to each use.
    - Inspection to include the power cord and plug.
- Wear proper eye and face protection while operating power tools.
- Never carry a tool by the cord or hose.
- Never yank the cord or the hose to disconnect it from the receptacle.
- Never stand in or near water when operating tools.
- Keep cords and hoses away from heat, oil, and sharp edges.
- Electric power tools will be either three-wire grounded or double-insulated and must be listed by Underwriters' Laboratories or another recognized listing agency.
- Disconnect tools and ensure a zero-energy state when not in use, prior to servicing and cleaning, and when changing accessories such as blades, bits, and cutters.
- Keep unauthorized people away from the work area by using signage, barricades, stanchions, keyed access, etc.
- Avoid accidental starting; do not hold fingers on the switch button while carrying a plugged-in tool.
- Maintain tools with care; keep them sharp and clean for best performance.
- Never leave tools unattended with parts still moving; even after the machine is turned off, some parts may still be capable of moving.
- Maintain good housekeeping practices by keeping the work area free of debris or other items that can get caught in tools or power equipment.
- Follow instructions in the user's manual for the tool when lubricating and changing accessories.
- Maintain good footing and balance when operating power tools.
- **Do not wear loose clothing, ties, lanyards, or jewelry** when operating portable power tools; such items can become caught in moving parts.
- Remove all damaged or defective portable electric tools from use and tag them: "Do Not Use." If not repairable, cut off power cord and discard/recycle.
- Always plug cord-connected, hand-held electric tools into ground-fault circuit interrupter (GFCI) protected receptacles or in compliance with the facility's assured electrical grounding conductor program.
- Cup wheels (Types 6 and 11) will be protected by safety guards or special "revolving cup guards" which mount behind the wheel and turn with it. They will be made of steel or other material with adequate strength and will enclose the wheel sides upward from the back for one-third of the wheel thickness.
- The maximum angular exposure of the portable grinding wheel periphery and sides for safety guards used on other portable grinding machines will not exceed 180° and the top half of the wheel will be enclosed at all times.
- Belt sanding machines will be provided with guards at each nip point where the sanding belt runs onto a pulley.
- Never clamp a hand-held grinder in a vise.

- When operating a riding rotary mower, never make sharp turns at high speeds, especially on a hill. Never put hands or feet under a running mower.
- Always shut off the mower and disconnect the spark plug before servicing or reaching under the mower deck.

Guards

Hazardous moving parts of power tools need to be safeguarded. For example, belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating, or moving parts of equipment shall be guarded if such parts are exposed to contact by employees.

Guards, as necessary, shall be provided to protect the operator and others from the following:

- Point of operation
- Nip points
- Rotating parts
- Flying chips and sparks

Power tool guarding precautions include the following:

- Always consult supervisor when the manufacturer recommendations for guarding a specific power tool are not available or cannot be implemented.
- Guards must not be removed or bypassed unless the power tool is unplugged or locked out from the power source and is in a zero-energy state.
- Notify a supervisor immediately when any unguarded moving parts or dangerous points of operation are observed. Stop work and shut down the tool until the condition is corrected.
- Do not use unauthorized or damaged guards.
- Operate power tools only when all guards are in place and properly attached according to the manufacturer's recommendations, and are functioning properly.
- If a guard is damaged, bypassed, or missing, the tool will be removed from service and tagged with **"Do Not Use"** until repairs can be made.

Guards on Portable Abrasive Wheel Tools

Portable abrasive grinding, cutting, polishing, and wire buffing wheels create special safety problems because they may throw off flying fragments.

Abrasive wheel tools must be equipped with safety guards that:

- Cover the spindle end, nut, and flange projections.
- Protect the moving wheel surface.
- Maintain proper alignment with the wheel; and
- Do not exceed the strength of the fastenings.

Before an abrasive wheel is mounted, it must be inspected for damage and should be sound or ring-tested to ensure that it is free from cracks or defects.

Safety Switches

All hand-held power tools will be fitted with any one of the following safety switch methods as appropriate for the particular tool:

- A momentary contact “on-off” control.
- A lock-on control provided that turnoff can be accomplished by a single motion of the same finger or fingers that turn it on.
- A pressure switch which requires constant pressure to run and will shut off when the pressure is released, such as required for hand-held angle grinders and disc sanders.

Electric Tools

Portable electric tools will be of the approved double-insulated type and used with an approved grounding device such as a ground-fault circuit interrupter (GFCI) to prevent the unlikely event of an electrical shock.

Electric power operated tool precautions include the following:

- Operate electrical tools only within their design limitations.
- Never use electrical cords for hoisting or lowering tools.
- Unplug the power cord by pulling on the plug rather than pulling on the cord.
- Keep cords and hoses away from heat, oil, and sharp edges.
- When not in use, store electrical tools in a dry place.
- Do not use electrical tools in damp or wet locations without authorization and proper precautions taken to prevent electrical shock.

Pneumatic Tools

Pneumatic tools are powered by compressed air and include chippers, drills, hammers, and sanders. Some hazards associated with pneumatic tools include noise, vibration, fatigue, and strains.

Pneumatic tool precautions include the following:

- Pneumatic power tools will be secured to the hose or whip by some positive means such as a tool retainer to prevent the tool from becoming accidentally disconnected.
- Safety clips or retainers will be securely installed and maintained on pneumatic impact (percussion) tools to prevent attachments from being accidentally expelled.
- Eye protection is required and face protection is recommended for employees working with pneumatic tools.
- Use appropriate hearing protection when working with noisy tools such as jackhammers.

- Screens must be set up to protect nearby workers from being struck by flying fragments around chippers, riveting guns, staplers, or air drills.
- The safe operating pressure stated by the manufacturer will not be exceeded.
- Pneumatic powered tools will be secured to the hose or connection by a positive means to prevent them from being accidentally expelled.
- Hoses will not be used for hoisting or lowering.
- All hoses exceeding 1/2 inch inside diameter must have a safety device to reduce pressure should the hose fail.
- All pneumatically-driven nail guns, staplers, and other similar tools provided with automatic fastener feeds which operate at more than 100 psi pressure to the tool will have a safety device on the muzzle end to prevent the tool from ejecting fasteners unless the muzzle is in contact with the work surface.
- A safety clip or retainer must be installed to prevent attachments, such as chisels on a chipping hammer, from being unintentionally shot from the barrel.
- Compressed air guns must never be pointed toward anyone. Users must never “dead-end” the gun against themselves or anyone else.
- Eye protection must be worn when operating a compressed air gun.
- Supplied compressed air will not be used for cleaning purposes except when reduced to 30 pounds per square inch (psi) and then only with effective chip guarding and with proper PPE.
- Airless spray guns which atomize paints and fluids and operate at pressure of 1,000 psi or more will be equipped with an automatic or visible manual safety device which prevents the accidental pulling of the trigger to prevent the release of paint or fluid until the device is manually released.
- Instead of the safety device, the gun may be equipped with a diffuser nut which will prevent high pressure and high velocity release while the nozzle tip is removed, plus a nozzle tip guard, or other equivalent protection, which will prevent the tip from coming into contact with the operator.
- Abrasive blasting nozzles will be equipped with a valve which must be activated manually for operation and a holding rack for non-operation. The nozzle will be mounted on a support when it is not in use.

Hydraulic Power Tools

The fluid used in hydraulic powered tools will be fire-resistant and must retain its operating characteristics at the most extreme temperatures to which it will be exposed. The manufacturer’s safe operating pressures for hoses, valves, pipes, filters, and other fittings will not be exceeded.

Jacks

A jack is an appliance for lifting and lowering or moving horizontally a load by application of a pushing force. Jacks may be lever and ratchet, screw, and hydraulic.

- The manufacturer's rated capacity for the jack will be legibly marked on all jacks and will not be exceeded. All jacks will have a positive stop to prevent and stop over-travel.
- When providing a firm foundation, the jack base, as well as the cap, will be blocked or cribbed to prevent slippage.
- Where there is a possibility of slippage of the metal cap of the jack, a wood block shall be placed between the cap and the load.
- Jacks will be maintained according to the manufacturer's recommendations and inspected at least every 6 months in addition to prior to each use.
- For jacks subjected to abusive conditions such as freezing, load shock, or extreme heat, the jack will be examined for possible defects prior to each use.
- Any jack found damaged or defective will be removed from service immediately and tagged with a "Do Not Use" tag. It is not to be used until repaired by a person qualified to perform such repairs.

Fuel-Powered Tools

- All fuel-powered tools will be stopped during refueling, servicing, or maintenance.
- Fuel will be transported, handled, and stored in accordance with USEPA and USDOT rules and procedures.
- When fuel-powered tools are used in enclosed spaces, the applicable requirements for toxic gas monitoring and use of PPE will be applied.

Powder-Actuated Tools

Powder-actuated tools are also known as "explosive-actuated." Such tools are actuated by explosives or any similar means, and propel a stud, pin, fastener, or other object for the purpose of affixing it by penetration to any other object.

Only employees who have been trained in the safe operation of the particular powder-actuated tool in use will be allowed to operate a powder-actuated tool.

<u>Powder-actuated tool precautions include the following:</u>

- Inspect the tool prior to each use.
- Any tool found not in proper working order, or which develops a defect during use, will be immediately removed from service, tagged "Do Not Use", and not used until properly repaired by an authorized provider.
- Tools will not be loaded until just prior to the intended firing time. At no time, loaded or unloaded, are the tools to be pointed at any employees.

- Hands will be kept clear of the open barrel.
- Loaded tools will not be left unattended or be accessible to unauthorized persons.
- Tools will not be used in an explosive or flammable environment.
- In case of a misfire, the operator will hold the tool in the operating position for at least 30 seconds and then try to operate the tool a second time. The operator will wait an additional 30 seconds, holding the tool in the operating position, then proceed to remove the explosive load in strict accordance with the manufacturer's instructions.
- Fasteners will not be driven into very hard or brittle materials including, but not limited to, cast iron, glazed tile, surface-hardened steel, glass block, live rock, face brick, or hollow tile.
- Driving into materials easily penetrated will be avoided unless such materials are backed by a substance that will prevent the pin or fastener from passing completely through and creating a flying-missile hazard on the other side.
- Fasteners will not be driven directly into materials such as brick or concrete closer than 3 inches from the unsupported edge or corner or into steel surfaces closer than ½ inches from the unsupported edge or corner, unless a special guard, fixture, or jig is used. (Exception: Low-velocity tools may drive no closer than 2 inches from an edge in concrete or ¼ inches in steel).
- When fastening other materials, such as a 2x4 inch piece of wood to a concrete surface, it is permissible to drive a fastener of no greater than 7/32-inch shank diameter not closer than 2 inches from the unsupported edge or corner of the work surface.
- Fasteners will not be driven through existing holes unless a positive guide is used to secure accurate alignment.
- No fastener will be driven into a spalled area caused by unsatisfactory fastening.
- Driving into materials easily penetrated will be avoided unless such materials are backed by a substance that will prevent the pin or fastener from passing completely through and creating a flying missile hazard on the other side.