

Hand and Power Tool Safety

Hand and Power tools are such a common part of our lives that workers can become complacent with the hazards they pose. Steps are needed to identify and prevent tool-related hazards before a severe incident occurs. Employees who use hand and power tools are exposed but not limited to the following hazards: falling, flying objects, abrasions, splashing objects, harmful dusts or fumes, mists, vapors and gases. Workers shall be provided with appropriate personal protective equipment (PPE) to eliminate exposures. Regular inspections of tools can reduce exposures. A sample inspection audit form is provided in Appendix A.

Five Basic Safety Rules to Prevent Hand and Power Tool Hazards:

- 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 and do not use damaged tools.**
- 4. Operate tools according to the manufacturers' instructions.**
- 5. Provide and properly use the right personal protective equipment (PPE).**

Misuse and improper maintenance increase hazards and commonly result in injury. Some examples of misuse and lack of maintenance include the following:

- If a chisel is used as a screwdriver, the tip of the chisel may break off or fly off, hitting the user or other employees.
- 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 employees.
- If the jaws of a wrench are sprung, the wrench may 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.

Ultimately the employer is responsible to keep tools and equipment in safe condition. However, it is the employee's responsibility to be able to identify hazards associated with different types of tools used on the job and the appropriate safety precautions necessary.

PPE

Appropriate PPE is necessary to protect against hazards encountered with the tool and job being performed. PPE must be utilized when required.

Eye Protection – safety glasses or goggles, worn at all times for eye protection. The following scenarios are examples of where eye protection is needed; however, it is not limited to these examples:

- Snipping wire with side-cutting pliers
- Striking a nail with a hammer
- Sawing wood

Cut Protection – Cut resistant gloves made of Kevlar, Spectra, or stainless steel can help protect against the instance of a misdirected blade. Standard cotton or leather gloves provide protection from splinters or skin abrasions from handling raw materials. Impact-resistant gloves with gel or rubber palms can reduce vibration necessary on jobs requiring long periods of hammering or vibration.

Foot Protection – Foot protection is offered by a reinforced toe in boot or shoe form. Footwear must be chosen in relation to the type of work environment.

HAND TOOLS

There's a wide range of hand tools including anything from pliers to axes. Hand tools are any tool that is powered manually.

Wrenches – (Ex. Socket, open-end, combination, adjustable, torque, etc.)

- It is imperative to choose a wrench that properly fits the fastener you wish to turn. There are two types, metric and American, so make sure the wrench fits the bolt accordingly to reduce slippage.
- Avoid extensions to improve leverage.
- Avoid open-end or adjustable wrenches for final tightening or breaking free frozen fasteners.
- Always try to pull on a wrench instead of pushing, in case the fastener breaks loose.
- Force should be put on the fixed end of an adjustable wrench.
- Never alter a wrench.
- Fastener should always be torqued to the correct specification, make sure not to over-tighten fasteners.
- Periodically inspect wrenches for damage, such as cracking, severe wear or distortion.
- Non-sparking wrenches in the presence of flammable vapors or dusts are recommended.

Pliers – (Ex. Lineman, diagonal cutting, needle nose, slip joint, locking tongue and groove, etc.)

- Avoid extending handle length to improve leverage.
- Cut hardened wire only with the pliers made for that intended job.
- Do not use pliers to turn nuts and bolts.
- When bending wire make sure the jaws can sufficiently grasp the material.
- Cut wire at right angles, not by bending the wire back and forth on the cutting edge.
- Non-sparking pliers in the presence of flammable vapors or dusts are recommended.

Hammers and Striking Tools – (Ex. Nail, soft-faced, ball-peen, chipping, sledge, setting, etc.)

- Use the correct hammer head, weight and size tailored to its designed purpose.
- Strike the surfaces squarely, avoid hitting at an angle because doing so could result in sparks occurring.
- Properly remove a hammer from service if there are any signs of excessive wear, cracks, mushrooming or chips.
- Do not use one hammer to strike another.
- Non-sparking hammers in the presence of flammable vapors or dusts are recommended.

Screwdrivers – (Slotted, Phillips, torx, hex, square, etc.)

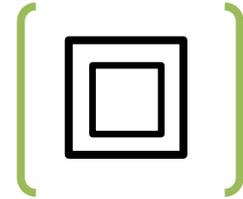
- Not for use as a pry bar, chisel, punch, stirrer or scraper.
- Utilize the proper screw driver tip for the intended purposes.
- When working near electricity, a lockout /tagout program must be utilized.
- Magnetic tipped or screw holding screwdrivers are recommended for tight areas.
- Non-sparking screwdrivers in the presence of flammable vapors or dusts are recommended.

PORTABLE POWER TOOLS

Exposures to hazards are generally increased with power tools because of the speeds at which they operate. There are many different types of power tools determined by their power source: electric, pneumatic, liquid fuel, hydraulic and powder-actuated. While using power tools it is essential for workplace floors to be kept clean and dry to avoid accidental slips, trips and falls. Due to the hazards power tools present, safety switches and guards are imperative. To reduce exposures the following fundamental precautions must be practiced:

- Never carry a tool by the cord or hose.
- Wear appropriate PPE.
- Tools must be operated within their design limits.
- Work areas should have adequate lighting.

- A cord should not be yanked to disconnect from the power source. To properly disconnect a cord from the power source grasp the plug end and proceed to remove.
- Double insulated tools are most convenient. They protect the workers in multiple ways. Double insulated tools are marked with “a square within a square”; they are constructed with a special insulated system in lieu of a grounding means.
- Protect cords from excessive heat, oil, and sharp edges.
- When servicing, cleaning, or changing accessories make certain the tool is disconnected from the power source and any residual power is eliminated.
- Maintain safe clearances with people not involved in the work.
- Fasten work in an appropriate manner to be able to utilize the tool with both hands.
- Avoid accidental start-up by keeping finger off the trigger while carrying. Sequential trigger systems are safest.
- Maintenance of tools not only increases longevity, keeping them sharp and clean also increases performance.
- Clothing must be appropriate when utilizing power tools. Loose clothing, jewelry, ties, sweatshirt strings, hair or beards increase exposure to hazards and risk.
- All damaged tools must be removed from use and tagged, “Do Not Use.”
- Ground Fault Circuit Interrupters (GFCI) are needed for any power tool being used on construction sites and are encouraged as best practice for power tools used elsewhere.
- Check for hidden wires that might make accidental contact while using a tool.
- Feed material only as fast as the tool is designed to, avoid excessive force.
- Adjustment knobs should be tightened and any adjustment key shall be removed before the tool is put back into use.
- Keep cords from presenting tripping hazards.
- When working at heights, don’t leave tools where they can accidentally be knocked off and pose threats to workers below.



SAFETY SWITCHES

Safety switches require constant-pressure of a switch or control that breaks the power when the pressure is released. The following hand-held power tools must be equipped with safety switches:

- Drills.
- Tappers.
- Fastener drivers.
- Horizontal, vertical and angle grinders with wheels larger than 2” (5.08 centimeters) in diameter.
- Disc sanders with discs larger than 2” (5.08 centimeters) in diameter.

- Belt sanders.
- Reciprocating saws.
- Saber saws.
- Scroll saws.
- Jigsaws with blade shanks greater than ¼ inch (0.63 centimeters) wide.

The following hand-held tools must be equipped with a positive “on-off” control switch, a constant pressure switch or a “lock-on” control:

- Disc sanders with discs 2” (5.08 centimeters) or less in diameter.
- Grinders with wheels 2” (5.08 centimeters) or less in diameter.
- Platen sanders.
- Routers.
- Planers.
- Laminate trimmers.
- Nibblers.
- Shears.
- Scroll saws.
- Jigsaws (blade shanks a nominal ¼ inch or less in diameter).

GUARDS

If moving parts are exposed there are increased hazards, chances of injury, and magnitude of injury. Belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating, or moving parts of equipment need guarding. Safe guards must never be removed when a tool is being used.

Types of Guards:

- 1. Fixed.**
- 2. Interlocked.**
- 3. Adjustable.**
- 4. Self-Adjusting.**

Protect workers and non-workers with machine guards in the following areas:

- **Points of operation.**
- **In-running points.**
- **Rotating parts.**
- **Flying chips and sparks.**

For instance, portable circular saws equipped with blades greater than 2 inches in diameter, must be equipped with a guard at all times. The blade must be covered by an upper guard, while a lower guard must cover the teeth, except where the blade makes contact with the material being

worked. The lower guard must return automatically to the covering position when the worked material is removed.

ELECTRIC POWER TOOLS

There are many hazards to be aware of while using electric type power tools. Among the most serious are electrical burns and shocks. According to OSHA, “approximately 350 electrical related fatalities happen each year.” Among the following are prevention methods that can be utilized to reduce risk and exposure to electrical burns and shocks:

- Storage of electric powered tools shall be in a dry place.
- Wear proper PPE such as eye protection and foot protection.
- Arrange cords from presenting tripping hazards.
- Don’t carry a tool by its cord.
- Avoid using electric tools in wet or damp places unless they are approved for that use.
- Assure adequate lighting is provided while using electric tools.
- Utilize GFCIs or an assured grounding program. GFCIs are required in the construction field.
- Only use tools that are double insulated or cord ends containing three prongs.

PORTABLE ABRASIVE WHEEL TOOLS

Fragmentation is an utmost concern when any abrasive grinding, cutting, polishing, or wire buffing is being performed. Abrasive wheels can become broken or damaged during shipping or from use. To reduce risk the following should be equipped on any abrasive wheel tool:

1. Spindle end, nut, and flange projections must be covered.
2. Maintain proper wheel alignment – wheels must be sound or ring tested to ensure there are not cracks or defects.
3. Strength of the fasteners must not be exceeded.

Damage prevention techniques can be incorporated by:

1. Performing a ring test upon use.
2. Using a wheel that freely fits on the spindle.
3. Tightening the spindle nut enough to hold the wheel in place without distorting the flange.
4. Following manufacturers’ recommendations.
5. Ensuring spindle speed does not exceed the maximum operating speed marked on the wheel.

Best Practices During Operation:

- Allow the tool to come to full operating speed prior to grinding or cutting.
 - Abrasive wheels may disintegrate or explode during start up.
- Avoid standing in the plane of rotation while the wheel accelerates to operating speeds.
- Make sure tools are equipped with a safety guard for protection from the moving wheel surface or flying fragments.
- Use eye, face and hand protection.
- Turn power off when not in use.
- Never clamp a hand-held grinder in a vise.

Performing a Ring Test –

- 1. Suspend the wheel by fastening a dowel into a vice.**
- 2. Make certain the wheel is dry and free of sawdust, or other materials, when performing a ring test.**
- 3. Gently tap the wheel with a light, non-metallic instrument. A healthy and undamaged wheel, when tapped, will have a clear tone, or ring. If a wheel is cracked or damaged there will be a dead sound, not a clear ring, because the ring is stopping at the damaged area. If a wheel has a dead sound, it shall not be used because fragmentation is more expected to occur.**
- 4. Rotate the wheel 45 degrees and repeat the test until the entire wheel has been checked.**

PNEUMATIC TOOLS

Pneumatic tools are powered by compressed air. Examples of these tools would include chippers, drills, hammers, ratchets, sanders, etc.

Best Practices During Operation:

- Check to see that the tools are fastened securely to the air hose. Safety clips or retainers should be used.
 - Disconnection could result in getting hit by the tool connection and/or fasteners alike.
- A short wire or positive locking device attaching to the air hose must also be used.
- An excess flow valve at the source of the air supply must be used for any hose wider than ½ inch (12.7 millimeters) in diameter.
- Assure the cords do not become tripping hazards.

- Be aware to not accidentally strike and damage the air hose.
- A special device to keep fasteners from being ejected is needed on tools that shoot nails, rivets, staples or anything similar at a pressure of over 100 pounds per square inch.
- An automatic or visible manual safety device that will prevent the trigger being pulled are needed on airless spray guns that atomize paints or fluids at pressures over 1,000 pounds per square inch.
- Compressed air for cleaning purposes must only be used at pressures less than 30 p.s.i.
 - Effective chip guarding and PPE shall be met using this method.
- Do not lift or lower a tool by its hose.
- Eye protection is required.
 - Head and face protection is recommended.
 - Appropriate use of ear protection when needed.
- When working with chippers, riveting guns, staplers and air drills, screens must be set up to protect nearby workers.
- Never point a compressed air gun at anyone, workers shall never “dead-end” a gun against themselves.
- Heavy jack hammers can cause fatigue and strains can become a result. While using jackhammers workers must:
 - Use heavy rubber grips to reduce vibration and increase grip.
 - Safety glasses, face shields and foot protection are required while operating jack hammers.
- Never leave a tool unattended.
- Never store a loaded gun.

LIQUID FUEL TOOLS

Liquid fueled tools are tools that are typically operated with gasoline, such as a lawn mower or chain saw. Gasoline is extremely flammable, consequently there’s a looming possibility that fuel vapors can explode or burn while operating liquid fuel powered tools.

- To prevent accidental ignition of flammable vapors, the engine must be shut down and cool before refilling.
- Handling, transportation, and storage of fuel or gas must be done in a careful manner and only flammable liquid containers shall be used.
- Refrain from using fuel powered tools indoors. However, if use inside a closed area is necessary, provide adequate ventilation and/or proper respirators.
 - Fire extinguishers must be in the immediate area.

POWDER-ACTUATED TOOLS

Powder-actuated tools are a type of nail gun used primarily in construction to join materials to hard substrates such as steel and concrete. Powder-actuated tools are very useful; however, they can be extremely dangerous. Seemingly, only specially trained employees may operate such a tool.

Best Practices During Operation:

- Eye, ear, and face protection are required.
- All powder-actuated tools must be designed for varying powder charges because selecting the appropriate level of powder needed is fundamental.
- The tool must not be able to operate unless it is pressed against the work surface with a force of at least five pounds greater than the total weight of the tool.
- Never point the tool at anyone else.
- Keep hands and feet clear of the barrel end.
- Never leave a tool unattended.
- A powder-actuated tool should not be used in an explosive or flammable atmosphere.
- Make certain proper maintenance has been performed on the tool before use.
- Do not fire fasteners through material that would allow a fastener to pass through the other side.
- An alignment guide is beneficial when firing fasteners into existing holes.
- Do not drive fasteners more than three inches from an unsupported edge or corner of material.
- Do not place fasteners in steel any closer than ½ inch from an unsupported edge; unless a special guard, fixture or jig is utilized.

Firing Issues:

1. If a misfire occurs, continue holding the tool in place for an additional 30 seconds before trying to fire it again.
2. If an additional misfire occurs, continue to hold the tool for an additional 30 seconds before following the manufacturers' recommendation to carefully remove the load.
3. The faulty cartridge should immediately be put in water.
4. If there's an issue with the tool it should be tagged and immediately taken out of service.

HYDRAULIC POWER TOOLS

Hydraulic-powered tools can create an immense amount of torque and power utilizing hydraulic fluid. The fluid used in hydraulics must be approved fire-resistant fluid. The fluid must also retain its operating characteristics at the most extreme temperatures to prevent any fires from occurring. Insulated sections of derrick trucks, aerial lifts, and hydraulic tools used on or around energized lines do not need fire-resistant fluid; instead the fluid shall be of the insulating type. During operation of any hydraulic tool, the manufacturers' recommended safe operating pressure must not be exceeded on any of the hoses, valves, pipes, filters, and other fittings.

While operating jacks:

- All types of jacks must have a stop indicator, which must not be exceeded.
- Manufacturers' load limit must be permanently marked.
- A jack must never be used to support or block a lifted load.
- If the lift surface is metal, place a one-inch thick hardwood block or equivalent between it and the metal jack head to decrease the chances of slippage.
- All jacks must be inspected before each use and lubricated regularly.
- Jacks exposed to freezing temperatures must be filled appropriately with antifreeze additive liquid.
- If a jack has been exposed to abnormal shock or load it should be thoroughly examined for damage.

A jack is properly set up if:

- **The base rests on a firm level surface,**
- **The jack is correctly centered,**
- **The jack head bears against a level surface,**
- **The lift force is applied evenly.**

This Guidance Document Has Been Developed By The Bureau Of State Risk Management, Department of Administration. The Guideline Was Adapted From A Publication Originally Developed By The Occupational Safety And Health Administration (OSHA).

Additional Resources

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Appendix A

Hand & Power Tool Audit			
Facility _____		Area _____	
Auditor _____		Date _____	
Area	Satisfactory	Action Required	Corrective Action (date)
Employee Knowledge			
Date Last Tool Training			
Hazards of faulty or improperly used tools			
Pre-Use Inspection			
Electrical Hazards			
Tool Adjustments			
Sharpening Procedures			
Proper Storage			
Program Administration			
Person Assigned for tool checkout / repair			
Designated Area for tool storage			
Respirators required when harmful dusts, fumes, mists, vapors or gases present			
Safeguards			
Engineering Safeguards			
Administrative Safeguards			

Training Safeguards			
Area Inspection			
PPE Being Used			
Bench Grinders Adjusted			
Equipment mounted to floor			
Machine guards in place			
Warning signs posted in shops			
Storage area neat, dry			
Tools in good condition			
Blades & cutting edges sharp			
Face shields used at grinders			
Grinding wheels dressed			
Rigging equipment tested			
Notes/Observations			

Operational Questions	
	Are all tools and equipment (both company and employee owned) used by employees at their workplace in good condition?
	Are hand tools such as chisels and punches, which develop mushroomed heads during use, reconditioned or replaced as necessary?
	Are broken or fractured handles on hammers, axes and similar equipment replaced promptly?
	Are worn or bent wrenches replaced regularly?
	Are appropriate handles used on files and similar tools?
	Are employees made aware of the hazards caused by faulty or improperly used hand tools?
	Are appropriate safety glasses, face shields, etc. used while using hand tools or equipment which might produce flying materials or be subject to breakage?
	Are jacks checked periodically to ensure they are in good operating condition?
	Are tool handles wedged tightly in the head of all tools?
	Are tool cutting edges kept sharp so the tool will move smoothly without binding or skipping?
	Are tools stored in dry, secure locations where they won't be tampered with?
	Is eye and face protection used when driving hardened or tempered spuds or nails?
	Are grinders, saws and similar equipment provided with appropriate safety guards?
	Are power tools used with the correct shield, guard, or attachment, recommended by the manufacturer?
	Are portable circular saws equipped with guards above and below the base shoe? Are circular saw guards checked to assure they are not wedged up, thus leaving the lower portion of the blade unguarded?
	Are rotating or moving parts of equipment guarded to prevent physical contact?
	Are all cord-connected, electrically operated tools and equipment effectively grounded or of the approved double insulated type?
	Are effective guards in place over belts, pulleys, chains, sprockets, on equipment such as concrete mixers, and air compressors?

	Are portable fans provided with full guards or screens having openings ½ inch or less?
	Is hoisting equipment available and used for lifting heavy objects, and are hoist ratings and characteristics appropriate for the task?
	Are ground-fault circuit interrupters provided on all temporary electrical 15 and 20 ampere circuits, used during periods of construction?
	Are pneumatic and hydraulic hoses on power operated tools checked regularly for deterioration or damage?
	Is the work rest used and kept adjusted to within 1/8 inch (0.375 centimeter) of the wheel?
	Is the adjustable tongue on the top side of the grinder used and kept adjusted to within ¼ inch (0.6350 centimeters) of the wheel?
	Do side guards cover the spindle, nut and flange and 75 percent of the wheel diameter?
	Are bench and pedestal grinders permanently mounted?
	Are goggles or face shields always worn when grinding?
	Are the maximum revolutions per minute (rpm) rating of each abrasive wheel compatible with the rpm rating of the grinder motor?
	Does each grinder have an individual on and off control switch?
	Is each electrically operated grinder effectively grounded?
	Are new abrasive wheels visually inspected and ring tested before they are mounted?
	Are dust collectors and powered exhausts provided on grinders used in operations that produce large amounts of dust?
	Are splash guards mounted on grinders that use coolant to prevent the coolant from reaching employees?
	Is cleanliness maintained around grinders?
Notes/Observations	