What are **hand tools?**

Many of today's on-the-job injuries result from the improper use of hand tools. Workers have lost their eyesight and had their vision impaired, tendons severed, bones broken, and arms, legs and fingers infected through puncture wounds, all because of unsafe practices with hand tools or use of tools poorly designed for the specific job.

There is no set of established codes concerning the proper use of hand tools. Because guards are not built into hand tools like they are on power hand tools, workers must be especially aware of safety precautions to prevent injuries.

It is necessary for training instructors to stress the seriousness of using hand tools.

The right tool is the safe tool

An accident-free shop begins when workers adhere to the rule of using the proper tools for jobs. When used properly, the right tool is the safe tool.

Safety must be an integral part of every trade training activity. Students learn why safety is so important through clear instructions and by performing tasks that require certain skills and knowledge.

No matter how mechanized an industry becomes, plant operations will still depend on hand tools.

It is extremely important that workers who use hand tools are properly trained. Do not assume workers automatically know how to use them correctly. They must know how to use tools safely and understand why certain procedures are safer than others.

Begin with hand tool training

An ideal beginning for any safety program is basic safety training in the use of hand tools. As a result, safety awareness will likely reach all areas of the plant.

Trainees in skilled trades must realize why emphasis is placed on the safe use of hand tools. They also need to receive experience guidance and instruction in safe practices.

The safe use of hand tools

All department heads should be familiar with the talent and skill of the workers and enforce the rules regarding safe handling of hand tools. Department heads should also provide special instruction and guidance for the worker if necessary. Such training will increase the safety of workers who use hand tools.

There is only one safe way to use hand tools, although there are special tools for almost every craft. Keep in mind that there are many ergonomically designed tools available today. The following list consists of tools most commonly used in metalworking and woodworking industries. These tools also can be the most harmful if improperly used.

Awls

Holding an awl at a right angle to the surface of the work will prevent injury-causing slips. To make a hole with an awl, turn it to the right and to the left as it begins piercing the material. Never carry an awl in a pocket because the sharp point may cause an injury.

Axes

Keep axes sharp for faster chopping and greater safety. Use only a thin-bladed narrow ax for hard wood, and a thick-bladed wide ax for soft wood. When an ax's edge is dull, it is more likely to slip off the surface, rather than cut it.

Make sure there is a clear circle in which to swing an ax. Keep axes protected by sheaths or metal guards when not in use. Check handles regularly for splits, looseness and re-wedging.

Bits

Store bits out of the way in a rack on the bench well. Scrapes and cuts can easily result from a storage rack of bits not kept in a safe place.

Chisels

In most cases, you can determine the safety of a hand tool by the condition of its cutting and striking ends, particularly in the case of edges and pointed tools, such as cold chisels.

A cold chisel with a mushroomed head (rounded over into sharp, thin edges by the repeated pounding of a hammer) is a common cause of injury to the worker. When a mushroomed head is pounded, chips may be knocked off the damaged head and fly into the eyes of the worker. Redress mushroomed heads on all hand tools.

Grind down the damaged end and then reform it with the use of an abrasive wheel. In the redressing process, a beveled edge will enable it to stand up under more pounding.

Cold chisels

An inadequate cold chisel will buckle or spring if the proper size and strength are not used for the metal being cut. Hold the chisel lightly in the hollow of the hand with palm up, supported by the thumb and first two fingers. If the hammer glances, it will strike the soft palm rather than the knuckles. When using larger chisels that require a fist hold, use a cushion for hand protection.

When shearing with a cold chisel, hold the tool at an angle, which permits one bevel of the cutting edge to ride flat against the shearing plane. Wear safety glasses when chipping or shearing with a cold chisel. Protect people in the immediate area with a shield or screen.

Wood chisels

Always drive a wood chisel by hand in an outward direction, away from the body.

Before using a wood chisel, remove nails and metal (such as corrugated fastener) from the piece of work, or drive them into the material. Otherwise, chips will fly off the imbedded metal or off the chisel itself. Avoid any type of prying or wedging with a chisel because it can cause the steel to snap.

Protect the sharp edges of chisels and store them in a rack, workbench or slotted section of a tool box. Safety hazards result if workers leave chisels on shelves or bench tops where they can roll off.

Crowbars

Use the correct size crowbar for each job. Do not use makeshift tools (cheaters) such as pipe lengths, iron bars or extensions for leverage. To prevent slips, place a block of wood under the head of the crowbar.

Cutters

Use heavy duty cutters when cutting heavy wire or reinforcing wire, bolts or strapping. It is unsafe to overload a light tool. Apply force at a right angle to the cutting edge, not at a slant. Never use cutters near live electrical circuits. When using cutters, always wear safety glasses. Never use claw hammers, crowbars or other pry tools to snap metal bands; use cutters and keep a gloved hand over the end that is likely to fly. When using cutters on bolts or reinforcing rods, hold the portion to be cut in one hand or cover it with a glove to keep it from flying. Never tamper with the adjustment on the cutter jaws.

Make adjustments only at the tool crib or let the manufacturer make them. In the hands of the untrained, alterations in the operation of cutters may result in improper clearance, which can cause the tool to bind, crack or break its jaws. Serious injury to the user is also possible.

Files

When using a file, have secure footing before applying pressure. Grasp the file with one hand and guide the point of the file with the thumb and forefinger of the other hand.

Use a vice to secure the material you are filing, and position the work piece to avoid awkward filing postures. Use an offset handle if it is available. Clean files require less force. The proper way to clean a file is with a file card; never strike it against another piece of metal because steel particles can fly off. Use the file in an approved handle.

Hacksaws

Apply pressure on the downward stroke only. After the forward pressure stroke, slightly lift the saw and lightly pull it back in the cut to protect the teeth. Twisting the blade or applying too much pressure may break the blade and result in hard or arm injuries.

Cutting too fast with a hacksaw will heat up the blade, untemper it and cause it to snap. Light machine oil or lubricants protect the blade against mishaps and help the hacksaw cut more efficiently.

Hammers

Take special care in selecting the correct type of hammer handle when replacements are made; each type of hammer head has a specific type of handle. Wedge the handle securely in the head and make sure it is free of splinters and cracks.

Never strike hardened steel surfaces with a steel hammer. Use a soft metal hammer or one with a plastic, wood or rawhide head. Always wear safety glasses to protect the eyes from flying chips, nail heads or scale.

Carefully inspect sledge hammers at regular intervals for split handles and loose or chipped heads. Selecting the right hammer for the job is important. Use riveting hammers for sheet steel, carpenter or claw hammers for driving and drawing nails, and ball-peen hammers for metal work.

Hatchets

When working with a hatchet, strike the wood lightly with the blade and then force the blade through by striking the wood against a solid object. Do not strike hard metal surfaces with the hammer end of the hatchet because the hardened head may chip or split. To avoid injuries to others, allow a sufficient amount of space to swing the hatchet.

Hooks

Keep hand hooks sharp to prevent slips. Shield the point of the hook with a one-inch piece of rubber hose or carry it in a specially designed sheath, or the point of the hook can be pressed into a small cork as a protective shield.

Jacks

Check the capacity plate (usually affixed to the side of the jack's housing) to determine the lifting power of the jack before it is put into service. Remove the jack handle when moving it from job to job.

Also, check the condition of the jack's holding fixture before each use. Broken teeth are hazardous.

Place the jack on a level surface before applying pressure and securely anchor the base with nailed blocks or wedges, or tie it with ropes to prevent creeping.

Set the jack at the same angle when raising the load by using wedges, iron plates or shims to prevent slipping. Remove the jack handle after reaching the desired elevation. If not removed, you may strike it, causing the jack to topple from under the load, which can result in serious injury.

Watch for leaks in hydraulic jacks, because oil and grease on the bottom of the under side of the jack are particularly hazardous.

Wear safety shoes and keep hands free of oil and grease when working with a jack. Use substantial blocking to support the load after it has been raised.

Knives

Use hand guards, mesh gloves or other safety equipment when working with knives. Try to cut away from the body, or keep the body clear and wear protective clothing. Avoid jerky motions, sudden strains or other movements that might cause loss of balance.

Keep a knife in a sheath or holder when carrying it on the job. Knives should never be left lying on benches or shelves. Keep them sufficiently sharp to do the work for which they are intended.

Planes

Store all planes in a rack designed to protect the cutting edges from damage and workers from injuries. Always keep the cutting edge sharp. Hold material being planed securely in a vise, clamp or other holding device.

Pliers

Directly apply pressure across the line of cut when using pliers. Never substitute pliers for a wrench or a hammer because pliers chew up nuts and bolt heads and make them unsafe for use by other workers. Also, pliers cannot grip nuts or bolts securely, which may result in loss of balance when the worker exerts turning force.

Electricians should use pliers with hand insulating grips. Make sure these protective coverings are free of cracks, holes or broken portions.

Securely hold the coil or length of wire in a vise when cutting it with pliers. Hold the open end of the wire with your free hand to prevent the cut-off end from flying.

If a vise is not available, kneel on the floor and hold the wire with one foot. Always wear safety glasses when cutting wire.

Saws

Use slow, careful, downward strokes to help the saw cut directly across material. Do not crowd or force a saw through the cut because the saw may buckle or fly out. Keep the saw sharp, properly set, and free of cracks and broken teeth.

Do not hang a saw overhead on hooks or leave it on the floor. To prevent scrapes and cuts, do not allow it to protrude from the end or edge of a bench.

Scraper

Only experienced workers may use scrapers. Keep scrapers sharp and in good condition. Store them in special racks to protect the edges and other workers.

Screwdrivers

When driving a screw into small objects, hold the object in a vise, not in the hand. If performing electrical work, never use a screwdriver with a shaft that extends all the way through its handle.

When selecting a screwdriver, consider the tip size. It should fit snugly in the slot of the screw to drive. Do not use a twisted screwdriver tip; when applying driving pressure on a twisted screwdriver tip, it slips and can result in injury. Never use a screwdriver as a punch, wedge pinchbar, pry or chisel.

Tin snips

Use one hand to operate the snips and the other to hold the edges of the metal being cut. Do not lean over to cut through the entire dimension when cutting wider, longer stock or when the material is likely to curl up. Alert and protect the worker next to the tin snip operation from the material that falls to the floor after the final cut. Wear safety shoes and goggles or a face shield for protection against the upward curl or spring of the metal as it is cut. Never force, hammer or step on the handles of tin snips to increase leverage. Use heavier duty snips when extra pressure is necessary.

On heavier materials, either reduce the thickness of the metal (if it is in layers) or operate the snips in short, creeping bites.

Wrenches

Always use the correct wrench for the job. Place the jaws on the nut and then pull the wrench, which will force it onto the nut. Use socket wrenches for hard-to-reach places, and to loosen and tighten nuts and other fasteners with the aid of a ratchet apparatus. The wrenches are available in a wide range of sizes.

Box wrenches have a box opening at both ends, each a different size. Use these wrenches to free frozen nuts.

Open-end wrenches are made with 15-degrees, different-sized openings at either end and are used for a variety of purposes. Do not use an open-end wrench to free frozen nuts. Never use a hammer on an open-end wrench, or use an extension on the handle.

Never use a pipe wrench on nuts because the corners of the nuts or bolts are likely to break the teeth of the pipe wrench jaws, making the tool unsafe for future use on pipes and fittings.

Manufacturers make every size of wrench with a maximum capacity, so the amount of leverage obtained with the wrench handle is the maximum application. It is an unsafe, tool-damaging practice to add more leverage.

Hand-tool storage

Periodic safety inspections of infrequently used hand tools are necessary. Mark such tools with the company's seal or name. Store them in the tool cribs of the departments where they are used or other proper places.

Set up records to cover tool repairing, replacement, checking and inventory. Inspect them at specific times on a continuous basis. Neglected tools can cause serious injury.

Provide tool bins and racks at the tool crib for each kind of hand tool owned by the company. Train the person who is responsible for the tool crib in safe and proper tool placement.

Protection against possible accidental contact with sharp-edged tools is important. Check the condition of the tool storage area regularly. Make sure that tools are stored properly.

Hand tools that are not stored properly often cause tripping or jabbing injuries. They can topple from an overhead storage shelf and strike a worker.

Many companies use a color-coding system to maintain better hand-tool control. Specific tools are color-coded to match the color of the machine or equipment on which they are used.

This system reduces the chance of these special tools being carried into other departments of the plant, where mishandling might occur.

Never place a tool box on the end of a bench where a person can knock onto a worker's feet. Also, it does not belong in an aisleway where another person may trip. If you must place a tool box on a workbench, use a rail to protect it against its being pushed off.

Inspect tool belts regularly for the condition of material, supporting strength for the tools carried, and ability to protect tools from damage. Make sure the belt is with the necessary pouches of sufficient depth to hold the tools firmly. The tools, however, should protrude enough at the top to allow the worker to get a firm grip before removing them for use.

Wear tool belts so that the tools hang at the side, hip-high. If the worker should fall, this provides protection against severe back and spine injures.

Hand-tool maintenance

A provision for a tool maintenance procedure is one of the most essential factors in any hand tool safety program. Extensively used hand tools require careful and frequent inspection to maintain their safe use.

When hand tools are not sharpened and dressed properly, injuries are often caused through inefficient cutting and glancing off the material being worked. Straighten bent shafts, replace broken handles, and discard tools that you cannot repair.

A tool's handle is often the cause of a worker's inefficiency and unsafe practices. If the handle is splintered, too short, loose-fitting or otherwise poorly affixed to the tool, the worker who uses it is exposed to possible injury. The worker should know how to tighten loose handles by rewedging the end of the handle that sticks through the head of the tool.

Remove any hand tool with a defective handle from service immediately.

Use a file rather than an abrasive wheel when dressing the tips of screwdrivers. The file will draw less temper from the screwdriver tip. Loss of temper in a screwdriver soon results in a damaged tool and possible injury to the worker using it. A hand tool that is not properly dressed and reconditioned can be hazardous.

Set up definite procedures in the safe maintenance of hand tools and establish wear, frequency of use and inspection guide limits. An efficient tool safety program requires periodic inspections of all operations involving hand tools.

Inspect the tool supply room at specific times and keep an inventory. Enforce all planned procedures and rules involving hand tool safety to reduce injuries.

Powder-Actuated Tools

Powder-actuated fastening tools (PATs) are popular in the construction industry when jobs call for a quick method of securing objects to concrete and steel bases. These tools work on much the same principle as a firearm, using a gunpowder charge to propel a fastening pin or stud.

What are PATs?

The military developed PATs during World War II as a means of attaching steel plates to the sides of ships, and eventually came into use in the civilian construction industry.

There are two types of PATs — direct-acting (high velocity) and indirect-acting (low-velocity). In a direct-acting tool, the expanding gases created by detonation of the gunpowder charge work directly upon the fastener, propelling it toward the base material. In an indirect-acting tool, the gases drive a piston, which, in turn, pushes the fastener into the base material.

The gunpowder cartridges for PATs fall into categories defined by the 12 different degrees of strength with test velocities ranging from 300 to 1,290 feet per second (fps). They are color-coded for easier identification. Formerly, you had to load cartridges one shot at a time. But PATs have evolved from single-shot tools to a multiple-shot design with cartridges available in strips of 10 or more. Fasteners also are available in strips of 10, although the operator must still cock the tool after each shot.

Fasteners, loaded into the muzzle end of the tool, are available in many lengths and holding capacities, each designed for use in a specific base material (hard or soft concrete, thick or thin steel) or for a specific purpose (threaded studs for bolting fixtures to a wall, for example).

Direct-acting PATs are still manufactured and sold. However, the lower-velocity, indirect-action tools are used much more often. In fact, the Occupational Safety and Health Administration and the American National Standards Institute construction standards recommend using "the lowest velocity tool that will properly set the fastener."

Fasteners in piston-driven tools (indirect action) travel at a lower velocity. In addition, when the piston stops moving, the driving action stops, reducing the chance of the fastener penetrating through the base material.

PATs operate on the same principle as a firearm and you must handle them with the same respect. However, there are also dissimilarities. For example, you cannot pick up, point and fire a PAT, like a gun because you must press the tool against a firm surface with at least 12 pounds of pressure before the trigger will function. Other safety features include a drop-firing safety device that prevents the firing pin from detonating the powder cartridge if the tool is dropped from 10 feet or lower. A tilt safety prevents the tool from firing if it is tilted too far from a right angle to the surface.

Safety features and rules

Despite the built-in safety devices, a lack of training with PATs can lead to accidents. To illustrate, a carpenter was using a PAT to build a plywood form prior to pouring a concrete wall. The fastener penetrated the plywood and struck a co-worker, killing him. Several basic safety rules of PAT use were violated, including;

- The person who last used the PAT should have unloaded the powder cartridge and removed the fastener before putting the tool away;
- The accident victim assumed the PAT was unloaded, instead of confirming;
- The victim should not have touched the muzzle of the PAT because pressure against the muzzle activates the firing mechanism.

Safety standards established for the construction industry require a certified instructor thoroughly train workers who operate PATs in the use of the tools. "Only persons trained and authorized by the tool manufacturer shall be qualified to instruct and qualify operators for the manufacturer's powder-actuated tools (American National Standard Institute A10.3)." In addition, operators must follow the manufacturer's requirements.

You may purchase PATs at various hardware stores and rent them from tool rental centers. It is the responsibility of the employer to get training for PAT users, and training must be applicable to the tool in use, as there are different models of PATs.

PAT training should consist of safety features of the tool, cleaning and maintenance, and proper operation and application. PAT operators also should be able to disassemble and re-assemble the tool.

Before you start

A PAT operator should know the proper application of the tool, and use it only for the intended purpose. Prior to using the tool, inspect for worn or defective parts, and make sure the barrel is free of obstructions. Do not use a defective PAT.

Determine the suitability of the base material with a pre-punch test, using a hammer and fastener to test the hardness of the material. If the point of the fastener flattens, the material is too hard; and if the material cracks, it is too brittle. If the fastener sinks into the material with a normal hammer blow, the material is not hard enough. Examples of unsuitable base materials are:

- Too hard — cast iron, welds;
- Too brittle — glass, glazed tile;
- Too soft — wood, drywall.

The tool's operator must be careful when fastening into concrete with a high quantity of hard aggregate or steel reinforcing rods. Striking one of these can cause the fastener to fishhook and ricochet toward the operator or other nearby workers.

A qualified operator should know the proper fastener to use for each base material. He or she must determine the appropriate power load. To do this, move from the weakest load to the highest, until finding the proper load.

Follow recommended guidelines for base material thickness, fastener depth, edge distances and fastener spacing.

Concrete

- Recommended thickness — at least three times the depth of fastener penetration
- Fastener penetration — 1 inch to 1 1/4 inch in low-strength concrete, 3/4 inch to 1 inch in average strength concrete, and 5/8 inch to 3/4 inch in hard concrete
- Distance from unsupported edge — 3 inches
- Fastener spacing — 2 1/2 inches apart

Steel

- Recommended thickness — at least 3/16 inch
- Fastener penetration — 1/2 inch. For thinner steel, the point of the fastener should penetrate the base material
- Distance from unsupported edge — 1/2 inch
- Fastener spacing — 1 inch apart

Observe basic construction safety rules such as the operators and co-workers wearing a hard hat and eye protection when operating a PAT. If working in a confined space, wear hearing protection. Never use a PAT in an explosive or flammable atmosphere. Be careful when fastening near live electrical circuits. When working on ladders or scaffolds, brace yourself to maintain good balance. Never carry a loaded PAT from job to job, and never point the muzzle of the PAT at any part of your body, especially when cocking the firing mechanism.

For the safety of co-workers and bystanders:

- Keep the tool pointed in a safe direction;
- Do not permit bystanders in the immediate area;
- Be sure the base material has no pre-drilled holes, for a fastener could easily pass through and injure someone;
- Do not leave the tool unattended;
- Unload the PAT when not using it, and store tools and cartridges in a locked container;
- Maintain a safe fastening distance from the edge of the base material because a piece could break off and become a dangerous projectile, or the fastener could ricochet and injure someone.

In case of misfire

In the event the PAT's power load does not detonate immediately, follow a strict procedure to prevent accidental discharge of the fastener. Hold the tool against the work surface for 30 seconds, giving the cartridge time to fire, then, pull the trigger again. If it still does not fire, eject the cartridge (holding the tool in a downward position at all times) and inspect it for indentation by the firing pin. If there is none, clean the breech face of the tool to allow penetration by the firing pin. Do not attempt to re-use the power load. Instead, dispose of the cartridge in a pail of water.

Cleaning and maintenance

Disassemble and clean PATs each day or after each 1,000 fastenings, whichever comes first. Inspect for worn or defective parts. Parts can become deformed by using too strong of a power load with too light of a fastener, for example. Replace the damaged parts only with parts from that tool's manufacturer to ensure safe operation. Take any PAT in need of repair our of service until the repair is made.