Basic Hand Tools

THE PROCESS of manufacturing anything is simplified by the use of tools. Even in today's technologically advanced world, almost all tools have a history that can be traced back to a number of basic hand tools. Learning how these tools operate and what they are used for provides a basis for working with almost any other tool.



Objectives:

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- 1. Identify general and specific safety procedures for basic hand tools.
- 2. Explain various uses for basic hand tools.

Key Terms:

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adjustable end wrench Allen wrench ballpeen hammer bevel box end wrench chisel claw hammer combination square coping saw cross cut crosscut saw eye protection fixed blade knife flat head screwdriver hack saw hammer knife lineman's pliers measuring device needle nose pliers noise-reduction device OSHA Phillips screwdriver pipe wrench pliers protective gloves right rip

rip saw ruler safety cutter knife saw screwdriver serrated sledge hammer slip-joint pliers tape measure torque wrench torx screwdriver user's manual wrench



Safety Practices

When working with any tool, safety should come first. Using a tool safely is accomplished by doing two important things. Always read the safe operating instructions that come with any tool. Also, follow general safety procedures applicable to all tools. Safety procedures have been established by OSHA—the Occupational Safety & Health Administration. **OSHA** is a governmental agency that regulates workplace safety and health. To safely operate any tool, OSHA recommends the following:

- Use a tool only for its specified purpose.
- Use a tool in the way specified by the manufacturer. Keep a file of each user's manual. A **user's manual** is a document provided by the maker of the tool that contains specific instructions for tool use. Fill out all warranty cards so you will be alerted regarding recalls and updates.
- Use the correct protective devices for each tool. Always wear eye protection. Eye protection is gear that guards the eyes (e.g., approved safety goggles). When appropriate, use noise-reduction devices when working around or with power tools. A noise-reduction device is protective gear for the ears (e.g., earplugs and headphones). When working with sharp tools, wear protective gloves. Protective gloves are gear made to guard the hands and are often made of leather or lined with leather.
- Keep tools in proper working condition. Tools used for cutting should be checked for dullness and should be sharpened when needed. Tools with handles should have their handles replaced if they are cracked or splintered. Tools that have joints or hinges should be checked for free movement. If the tools do not move freely, they should be lubricated or freed of rust (if present). Always remove rust, dirt, and other debris from tools before and after every use.
- Always inspect tools for damage before each use. Never use a damaged tool.



BROADENING AWARENESS...

AMAZING ASPECTS: Workplace Injuries

Last year, the Bureau of Labor Statistics reported that 230,290 cases of workplace injury resulted from contact with equipment and objects at work. This is an incident rate of approximately 28 injured people out of every 10,000 workers. These injuries were serious enough to require the injured worker to miss multiple days of work. Fatal injuries were not reported in these statistics.



Proper Hand Tool Usage

Basic hand tools can be broken down into specific categories based on the job that they were designed to do. Each type of hand tool has a specific purpose and carries with it additional safety measures that should be followed. Using a tool for its specific purpose and following its designated safety procedures will help to insure that injuries are avoided and a job is performed correctly. The following categories will describe the purpose and appropriate safety measures for specific hand tools.

HAMMER

A **hammer** is a device used to strike objects or other tools and to assemble, disassemble, or shape. Because it is used to strike objects, it can cause chips of metal, or other substances, to fly through the air. For this reason, you should always wear eye protection when using a hammer. Acceptable eye protection is found by using industry-approved goggles or safety glasses. Additionally, if a hammer has a cracked or damaged handle, it should not be used. The handle may break and cause the metal end of the hammer to fly and hit someone, resulting in injuries.



FIGURE 1. Examples of hammer types.

Sledge Hammer

A **sledge hammer** is a device that has a larger striking head and a longer and larger handle than a traditional striking device. Generally, two hands will be needed for use, and the head of the hammer will weigh more than one pound. A sledge hammer is used to drive large spikes and to help demolish structures and objects.

Ballpeen Hammer

A **ballpeen hammer** is a striking device that has a head with a distinct bulb-shaped head on one end and a traditional flat striking head on the other. A ballpeen hammer is used if shaping and molding is to take place. The ballpeen (rounded end) is intended to be used as an aide in shaping metal objects.

Claw Hammer

A **claw hammer**, sometimes called a carpenter's hammer, is a striking device with a traditional flat end on one side of its head and a two-pronged claw on the other end. This hammer is used for driving and pulling nails.

WRENCH

A wrench is a tool used to tighten or loosen connecting devices (e.g., screws, bolts, nuts, pipes, and connecting collars). Some types are adjustable end, box end, Allen wrenches, and pipe wrenches. Since wrenches are designed to grasp objects tightly, the person using the wrench should be aware of potential slipping of the wrench. When using a wrench on an object that will not turn easily, it is best to ask others to stand a safe distance away and for the user to proceed with steady and controlled pressure.



FIGURE 2. Examples of wrench types.

Adjustable End Wrench

An **adjustable end wrench** is a wrench that can be opened to various widths by turning a horizontal screw at the top of its handle. It is most useful in situations in which the size of the bolt, nut, etc. is unknown and the work space allows enough room for its usage.

Torque Wrench

A **torque wrench** is a type of wrench that is able to measure the amount of pressure being applied to the bolt, nut, etc. as it is being tightened. It is useful in situations in which too much pressure can result in failure of the connecting device.

Box End Wrench

A **box end wrench** is a type of wrench made to a specific opening size. It can be measured in metric or English units, and it will be open on one end. This allows for the wrench to be slipped over the bolt, nut, etc. so it can engage in tightening or loosening.



Allen Wrench

An **Allen wrench** is a wrench formed in the shape of a hexagon that is inserted in openings that match the size. It is different from other wrenches in that it is inserted into a bolt, whereas other wrenches wrap around the bolt head. This wrench type can only be used where a specifically designed opening is available.

Pipe Wrench

A **pipe wrench**, sometimes called a monkey wrench, is a tool used to tighten and loosen pipes and their fittings. It is unique in that it generally can open to much greater widths than standard wrenches and the jaws are **serrated**—the surface has been cut into ridges resembling teeth.

PLIERS

A **pliers** is a tool used to grip, hold, bend, and cut. Pliers can slip in much the same way wrenches, so similar safety measures should be used. If pliers are used around electrical wiring, they should have insulated (rubber) handles.

Slip–Joint Pliers

A slip-joint pliers is a tool

designed to expand the range of

FIGURE 3. Examples of types of pliers.

opening sizes for its jaws. This is accomplished by adding a series of channels along the body of the pliers so the user can expand the width of the jaws to achieve parallel jaw alignment. A parallel alignment allows for the strongest grip of the bolt (or other item) to be held.

Needle Nose Pliers

Fixed joint pliers are tools that allow for only one range of opening width for the jaws of the pliers. A **needle nose pliers** is a tool with a long, slender set of jaws and is designed to hold small objects.

Lineman's Pliers

A **lineman's pliers** is a tool used primarily by electricians and is equipped much the same as standard fixed joint pliers, except it also has a cutting device so wires can be snipped with the same tool.

E-unit: Basic Hand Tools



SCREWDRIVER

A **screwdriver** is a tool used for turning screws and bolts. This tool type comes in many forms designed to fit specific and varying screw openings. A screwdriver should never be struck or used like a chisel, as it may chip and shatter. This would result in flying debris.



FIGURE 4. Examples of tips found on different versions of screwdrivers.

Phillips Screwdriver

A **Phillips screwdriver** is a tool that has a four-edged cross shape to its head. It comes in various sizes and is designated by the head size as #1, #2, #3, etc.

Torx Screwdriver

A **torx screwdriver** is a tool that has a star-shaped head with six ridges. It comes in various sizes, and size designations are shown as T1, T2, T3, etc. A torx screw is likely to be found in finely manufactured items (e.g., electronics and automobiles). Less slippage occurs with a torx screw, and it typically lasts much longer than a Phillips.

Flat Head Screwdriver

A **flat head screwdriver**, sometimes called standard, is a tool that has one straight flat edge used for tightening screws. It comes in various sizes.

SAW

A **saw** is a tool used for cutting various types of materials. The purpose of a saw and its distinction comes from the material from which it is made and the design of its teeth. It is designed to be very sharp. For this reason, it is recommended that a user wear protective gloves.

Coping Saw

A **coping saw** is a tool used to cut designs that have curves. It is composed of a wooden or plastic handle attached to a thin, flexible blade. The blade allows for the user to bend it to meet curves in the design.



Rip Saw

A **rip saw** is a specialized tool designed to make rip cuts. A rip cut is a cut that goes with the grain of the wood. Its teeth are similar to chisels. In addition, the teeth are not angled forward or backward.



Crosscut Saw

A crosscut saw is a specialized tool designed to make cross cuts. A **cross cut** is a mark designed to cross the wood grain, which is the opposite of a rip saw. Additionally, the teeth of a cross cut saw will be angled in opposite directions on each side of the tooth.



Hack Saw

A hack saw is a tool specifically designed to cut metal. It is composed of a long, narrow saw blade with small and sharp teeth. If a hack saw is used on wood, it will not cut well because the small teeth will quickly become clogged with sawdust.

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CHISEL

A **chisel** is a metal tool with a sharp edge used for cutting stone, metal, and wood. A chisel generally has a **bevel**—a surface formed with a slope.

MEASURING DEVICE

A measuring device is a tool that can be separated into many different units (metric and English). It is used to determine the length of objects.

FIGURE 6. Example of a chisel.



Tape Measure

A **tape measure** is a flexible length of thin metal with metric or English measuring units on it. The tape is rolled and contained within some type of housing. When in use, the tape is pulled to the desired length to measure. Many tape measures have a locking mechanism that allows the tape to stay expanded while measurement is noted. Injury (specifically a cut) can occur if the locking mechanism is released while a person's hand is touching the edge of the tape.

Ruler

A **ruler** is a straight length of wood (or other material) divided into equal segments, such as inches. Each segment is usually broken into smaller segments that divide it into equal units.

Combination Square

A **combination square** is a measuring device shaped in a 90degree L pattern. It serves two purposes: to measure and to determine if a corner is right. **Right** is a corner that measures 90 degrees.



FIGURE 7. Example of a combination square.

KNIFE

A **knife** is a device with a sharpened edge that is used to cut various materials. A knife blade should be kept sharp, and caution in their use should always be emphasized. Cutting should always be in a motion away from the body.

Safety Cutter

A safety cutter knife is a

tool with thick handles that allows for the blade to be withdrawn into the handle. This allows for safe storage when it is not in use.

Fixed Blade

A fixed blade knife (X-

Acto) is a small tool with a fine blade. While X-Acto is a name brand, it is used much the same



FIGURE 8. Examples of types of safety cutters.



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ON THE JOB...

CAREER CONNECTION: Industrial Engineer

According to the Bureau of Labor Statistics (BLS), an industrial engineer earns a median salary of \$75,000 a year. An industrial engineer looks for ways to improve the efficiency of the manufacturing process. He or she must possess a working knowledge of the tools and equipment being used as well as the manufacturing process. A bachelor's degree is required.

way as Xerox to describe copiers. This knife is generally used for crafts and small projects. The blade is extremely sharp, so caution in its use should be emphasized. Cutting should always be in a motion away from the body.

Summary:

Modern hand tools have improved a great deal from their pre-historic counterparts, but they still serve the same basic purpose: to improve the standard of living for people's lives. Many varieties and manufacturers of hand tools exist. Learning how the tools are used and what they are used for is easier than ever.

With the use of any hand tool comes the responsibility to use it safely. The best resource for safe tool usage is found in the user's manual, which is the instruction sheet that the manufacturer provides with its tool. In the absence of a manual, many Web sites provide additional safety instructions. Tools should always be used in a safe manner for their intended purpose.

Checking Your Knowledge:



- 1. What are the five general safety directions that can be applied to any hand tool?
- 2. What government agency is responsible for insuring a safe work environment?
- 3. What category of tools would be best for tightening bolts, screws, and pipes as well as connecting collars?
- 4. When using tools designed for striking, what safety equipment should always be worn?
- 5. What tool would best be used for insuring that a board was perfectly square?

Expanding Your Knowledge:



Visit a local home improvement store. Take a list of hand tools you are interested in, and ask the clerk in the hardware department which type and brand of tool is



recommended in each category. Make sure to ask the clerk for his or her reasons why.

Web Links:



Projects

http://www.popularwoodworking.com/advice-and-woodworking-plans-forbeginners

Safety

http://www.osha.gov/doc/outreachtraining/htmlfiles/tools.html

Tools

http://www.northerntool.com/shop/tools/category_power-tools

