# OROMIA TVET- BUREAU

## NTQF Level - I

# Learning Guide -1

**Unit of Competence: - Use Construction Hand and Power Tools**

**Module Title: Using Construction Hand and Power**

**LG Code: CON ICW1 M08 LO1-8 LG-1**

**TTLM Code: CON RCW1 M04 TTLM 0519v1**

## LO1: Identify hand and power tools

| Instruction Sheet-1 | Learning Guide #-1 |
|---|---|

This **learning** guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Adhere to OH&S requirements
- Identify  Quality assurance requirements for company operation
- Types and functions of hand and power tools
- Recognizing access to power supply

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, upon completion of this Learning Guide, **you will be able to –**

- OH&S requirements
- Identify  Quality assurance requirements for company operation
- Types and functions of hand and power tools
- Recognizing access to power supply

**Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 2 to 24.
3. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-check 1” **in page 25** .
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).
6. If you earned a satisfactory evaluation proceed to “Information Sheet 1”.  However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
7. Submit your accomplished Self-check.  This will form part of your training portfolio.

| Information Sheet-1 | CONTENT-1 |
|---|---|

## 1.1 Adhere to OH&S requirements

The OHS plan has to set out the health and safety arrangements, applicable site rules, all relevant method. Statements associated with the work to be carried out, a risk assessment for any risk which can reasonably be expected and risk reducing measures if the work includes one of the following risks (list not exhaustive)

### 1.1.1 Safety and Prevention Principles

At a minimum, it is expected that the following general principles of prevention set out in descending order of preference are followed by all Contractors.

- Avoid risks by substituting dangerous with non-dangerous procedures.
- Evaluate unavoidable risks.
- Combat risks at source.

Work involving the assembly or dismantling of heavy prefabricated components. On the installation site all Contractors must: Fully observe the Life -saving Rules and the Rules of Conduct set out by the company responsible for the site management;

Report any safety hazard noticed on site or malfunction of any item of tool or plant immediately to the Site Manager; Supervisor, to ensure their personal safety and the safety of others; Bring and wear suitable Personal Protective Equipment (hereinafter referred to as gas.

Employers are responsible for maintaining in good repair any tools and equipment supplied to workers. Workers must use tools and equipment properly and report any defects to supervisors.

The Construction Regulation (O.Reg. 213/91) requires that tools and equipment be used according to manufacturers' operating manuals, that operating manuals for tools and equipment rated at more than 10 horsepower be kept readily available on the project, and that tools and equipment be inspected regularly. Our finest tools are our **hands**.

Too often they are damaged by tool accidents. Hands can be caught in machines, crushed by objects, or cut by sharp-edged tools such as chisels, knives, and saws. Hands can also be damaged by being burned, fractured, or sprained unless you stay alert. **Eyes** are highly susceptible to injury from tool use but eye injuries are almost always preventable. Use the

guards and personal protective equipment which we all know are needed but sometimes tend to overlook. Noise is a hazard inherent in construction.

Tools and the working environment can both be noisy, particularly for construction trades operating in plants and mills. Exposure to excessive noise can impair hearing. Prolonged excessive exposure can result in permanent damage to the hearing and eventually deafness. Hearing protection should be worn whenever there is a risk of excessive exposure

### 1.1.2 Common Causes of Accidents

Typical causes of hand and power tool accidents include the following:

- using the wrong tool for the job
- tools falling from overhead
- sharp tools carried in pockets
- using cheaters on tool handles
- excessive vibration
- using tools with mushroomed heads
- failure to support or clamp work in position
- carrying tools by hand up or down ladders
- using damaged electrical cords or end connectors
- Failure to use ground fault circuit interrupters (GFCIs), especially outdoors.

### 1.1.3 Safe Practices

Basic hazard awareness and common sense can prevent serious injuries with hand and power tools. As a general rule follow the safe practices listed below.

a) **Always wear eye protection.**

There is always the risk of flying particles and dust with hand and power tools. Appropriate eye protection is essential and must be worn by the user and others nearby.

b) **Use the right tool for the job.**

Using a screwdriver as a chisel, using a cheater on a wrench handle, or using pliers instead of a proper wrench are typical examples of the mistakes which commonly lead to accidents and injuries.

c) **Use tools as recommended by the manufacturer.**

For example, don't use cheaters on handles. This will exert greater forces on the tool than it was designed for and is likely to cause breakage and possible injury.

d) **Damaged or broken tools should be removed from service.**

Chisels with mushroomed heads, hammers with cracked or loose handles, wrenches with worn jaws, damaged extension cords, and ungrounded tools are all unsafe and should be removed from service and be either repaired or destroyed.

e) **Maintain tools in safe operating condition. Prevent mushrooming.**

Tools which are struck by hammers, such as chisels or punches, should have the head ground periodically to prevent mushrooming.

f) **Keep handles secure and safe.**

Don't rely on friction tape to secure split handles or to prevent handles from splitting. Check wedges and handles frequently. Be sure heads are wedged tightly on handles. Keep handles smooth and free of rough or jagged surfaces. Replace handles that are split, chipped, or that cannot be refitted securely.

g) **Keep hand tool cutting edges sharp.**

Sharp tools make work easier, improve the accuracy of your work, save time, require less effort, and are safer than dull tools.

h) **Never climb ladders with tools in your hand.**

Tool holders and pouches free the hands while workers are climbing or working on ladders, scaffolding, and other areas where access may be difficult. When carrying tools up or down from elevated places, put them in substantial bags or boxes and raise and lower them with strong rope

i) **Spark-resistant tools**

(Non-ferrous tools) are recommended where flammable materials or explosive dusts or vapors might be present. These tools, such as brass or copper hammers or mallets, should still be used with caution; remember, they may not guarantee safety in all explosive situations such as in the presence of gasoline vapors. It is always safer to eliminate the hazard by unsafe atmosphere through isolation, ventilation, or purging.

j) **Protect the cutting edges of tools when carrying them**.

Carry them in such a way that they won't be a hazard to yourself and others. Carry pointed or sharp edged tools in pouches or holsters.

k) **Keep your hand tools clean.** Protect them against damage caused by corrosion. Wipe off accumulated dirt and grease. Dip the tools occasionally in cleaning fluids or solvents and wipe them clean.

l) **Lubricate** Adjustable and other moving parts to prevent wear and misalignment.

m) **When swinging a tool** Be absolutely sure that no one else is within range or can come within range of the swing or be struck by flying material.

n) **Falling tools Is** a dangerous hazard for workers below? Keep track of tools, especially when working at heights on scaffolds or other access equipment. An unnoticed file or chipping hammer, if accidentally kicked off the work platform, is a deadly missile as well as a tripping hazard for you. **If practical, tie tools off when working at heights.**

o) **Hearing protection Should** is worn whenever there is a chance of excessive noise exposure. Noise from tools and equipment is an inherent hazard in construction. Exposure to excessive noise can impair hearing. Prolonged excessive exposure can result in permanent damage to hearing and eventually deafness. Although the tools being used are only one of several possible sources of noise, efforts should be made to provide the least noisy power tools that will still do the job.

## 2.1 Identification of Quality assurance requirements for company operations

If organizations wish to achieve continuous quality improvement they need to use appropriate selection of quality to be and techniques. In this paper a review of possibilities of the systematic use of seven basic quality tools (seven quality control tools) is presented.

It is shown that seven quality control tools can be used in all process phases, from the beginning of a product development up to management of a production process and delivery. It is further shown how to involve seven quality control tools in some phases of continuous improvement process. (PDCA-cycle) , Six Sigma (DMAIC) and Design for Six Sigma (DMADV) methodologies, and Lean Six Sigma.

**Keywords: DMAIC, improvement processes, quality tools, Six Sigma, PDCA, 7QC tools, DMADV**

Continuous quality improvement process assumes and requires that a team of experts together with the company leadership actively, use quality tools in their improvement activities and decision making process. Currently there are a significant number of quality assurance and quality management tools available, so the selection of the most appropriate is not always an easy task. Tools are essential ingredients of a process and basic instruments for

the success of a quality program. Many companies have used tools without giving sufficient thought to their selection and have then experienced barriers to progress.

Quality Tools cannot remedy every quality problem but they certainly are a means for solving problems. Consequently, it needs to be emphasized that while tools can be very effective in the right hands, they can be very dangerous in the wrong hands. It is, therefore, important to know how, when and which tools should be used in problem solving or improvement processes

Today there are more than a hundred different tools available. Many scientists have tried to define them and differentiate among them on various bases. Tools are generally a means of accomplishing change and in this paper we will focus on the most fundamental quality tools called the seven basic quality tools - 7QC tools.

They are easy to learn and handle and are used to analyze solutions to existing problems these seven quality tools which are basic for all other tools are:

- Flow chart
- Pareto diagram
- Check sheet
- Control chart
- Histogram
- Scatter plot
- Cause-and-effect diagram.

The seven quality tools were first emphasized by Ishikawa (in the 1960s), who is one of the quality management gurus. His original seven tools include stratification, which some authors later called a flow chart or a run chart.

They are also called the seven "basic" or "old" tools. After that other new tools have been developed for various purposes but the basis for every work is related to the 7QC tools .These tools are also fundamental to Kaizen and Juan's approach to quality improvement [2].

### 1.2.1 APPLICATION OF 7Quality Control TOOLS

These simple but effective "tools of improvement" are widely used as "graphical problem-solving methods" and as general management tools in every process between design and delivery. The challenge for the manufacturing and production industry is for:

"Everyone to understand and use the improvements tools in their work". Some of the seven tools can be used in process identification and/or process analysis.

One possible approach, proposed by J. G. Pimblott [4] is presented in Fig. 1 where Pareto and Cause and effect diagrams are common and essential in both processes (identification and analysis). The current approach for using 7QC tools, according to EOQ (European Organization for Quality) , is shown in Fig. 2. The process of data acquisitions includes three tools (Check sheet, Histogram and Control chart), and the process of analysis another four tools (Pareto diagram, Cause and effect diagram, Scatter plot and Flow chart). Here is a distinction between the two approaches represented in Figs. 1 and 2. The approach in Fig. 1 is much older (1990) and therefore, there are some key distinctions. Some tools which are now used only for analysis were at that time considered as tools for identification for both processes (identification and analysis). But even then scientists were attempting to find appropriate utilizations of each tool in different processes and methodologies of improvement. The tools must meet the main purpose or reason for their application. No single tool is more important in isolation, but could be most significant for a specific application

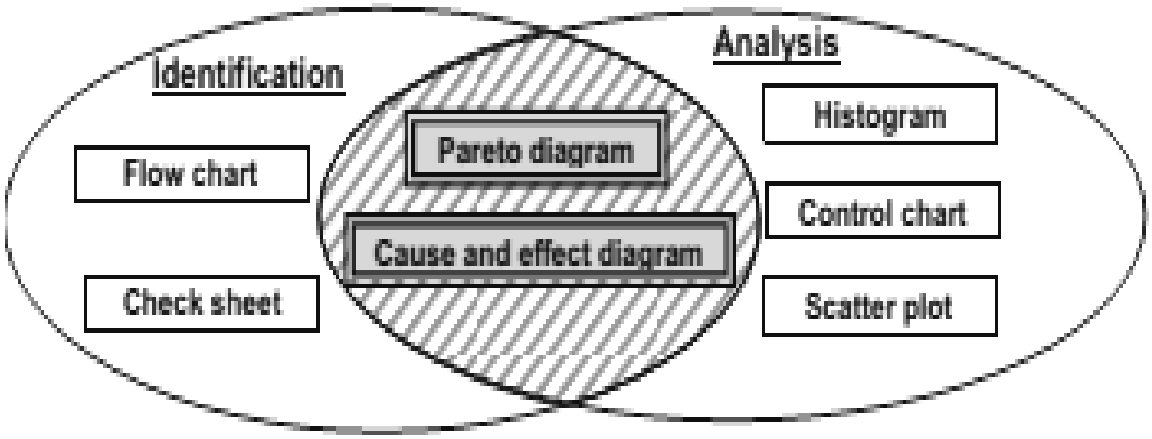



Fig. 1. *Use of 7QC tools in process identification and analysis*

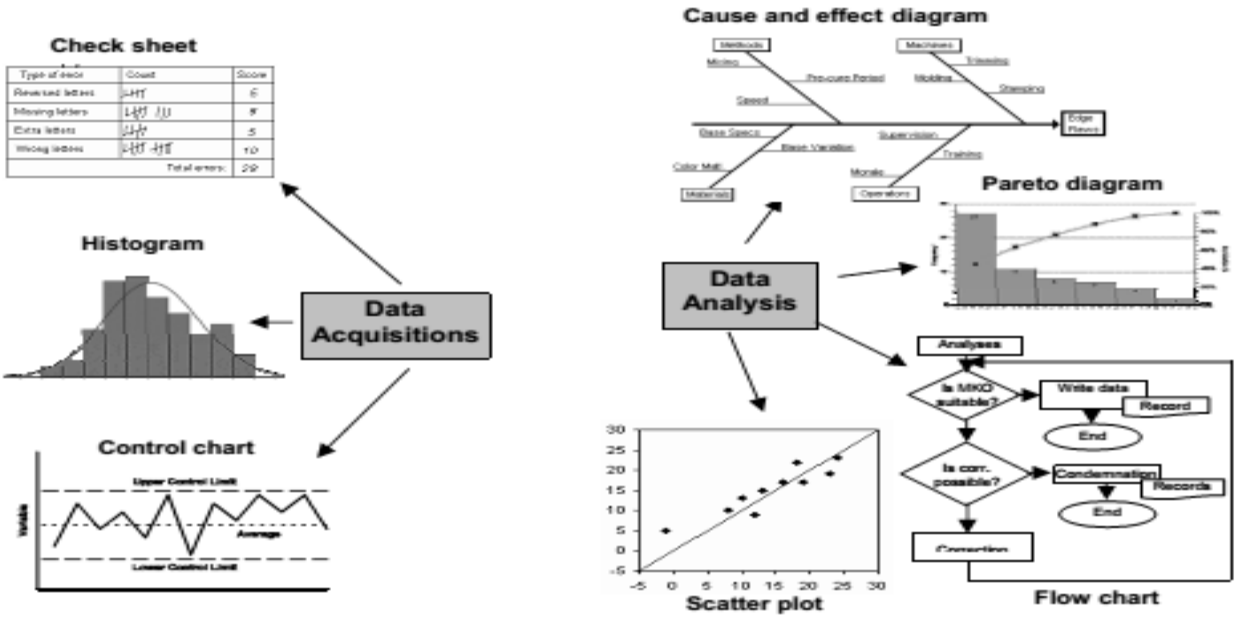



Fig. 2. *Current approach for using 7QC tools (according to EOQ)*


Fig. 3. *Development of quality management concept*

In successful application of quality tools and implemented quality management system is an advantage. The quality management principles are a starting point for the company's management striving for continuous efficiency improvement over a long period of time and customer satisfaction.

A quality management system is based on the integrity of all production and support resources of a certain company. It enables a faultless process flow in meeting related contracts, standards and market quality requirements. Implementation of a quality management system is always a part of a company's development process, Fig. 3 [6].

Having a quality management system in place is a prerequisite for its successful application on a day-to-day basis. The management has to show commitment to

development and improvement of a quality management system. Through a quality management system the company's leadership implements their quality policy. Furthermore, a quality management system has to be well documented.

When in function, the quality management system provides useful information obtained by different process analyses and audits. If a company's focus is on the customer, the company has to select the most efficient ways of data acquisition and market survey to confirm that the company's products or services meet customer demands and expectations.

- The gathered information is invaluable in the decision making process based on fact. Data collection and analysis is also significant in defining opportunities for further processes and product quality improvement. Continuous improvement as a fifth principle of QMS (ISO 9001:2000) could not be realized without quality tools which are presented through four groups of activities of Deming's quality cycle or PDCA-cycle, shown in Fig. 4 [6]**.** The PDCA-cycle is an integral part of process management and is designed to be used as a the completion of one cycle continues with the beginning of the next. A PDCA-cycle consists of four consecutive steps or phases, as follows:
- Plan - analysis of what needs to be improved by taking into consideration areas that hold opportunities for change.
- Decision on what should be changed.
- Do - implementation of the changes that are decided on in the Plan step.
- Check - Control and measurement of processes and products in accordance to changes made in previous steps and in accordance with policy, goals and requirements on products. Report on results.
- Act - Adoption or reaction to the changes or running the PDCA-cycle through again. Keeping improvement on-going.

Table 1. *Seven basic quality tools (7QC tools) in correlation with PDCA-cycle steps*

| Seven basic quality tools (7QC tools) | Steps of PDCA-cycle | | | | |
|---|---|---|---|---|---|
| | Plan | Do | Plan, Check | Plan, Act | Check |
| | Problem identification | Implement solutions | Process analysis | Solutions development | Result evaluation |
| Flow chart | ✓ | | | ✓ | |
| Cause-and-effect diagram | ✓ | | ✓ | | |
| Check sheet | ✓ | | ✓ | | ✓ |
| Pareto diagram | ✓ | | ✓ | | ✓ |
| Histogram | ✓ | | | | ✓ |
| Scatter plot | | | ✓ | ✓ | ✓ |
| Control charts | ✓ | | ✓ | | ✓ |

The main purpose of PDCA-cycle application lies in process improvement [7]. When process improvement starts with careful planning, it results in corrective and preventive actions supported by appropriate quality assurance tools which lead to true process improvement. The application of the seven basic quality tools in correlation with four steps of PDCA-cycle is shown in Table 1 [8].As shown in Table 1, most of the 7QC tools can be used for problem identification: Flow chart,
Cause-and-Effect diagram, Check sheet, Pareto diagram, Histogram and Control charts. For problem analysis the following tools can be used: Cause-and-Effect diagram, Check sheet, Pareto diagram, Scatter plot and Control charts. When a
team is developing a solution for the analyzed problem, Flow chart and Scatter plot can be useful as well. In the phase of achieved results evaluation, most of 7QC tools can also be successfully implemented: Check sheet, Pareto diagram, Histogram, Scatter plot and Control charts.

## 1.3 Types and functions of hand and power tools

### 1.3.1 Types and Functions of hand tools

Hand tools serve a variety of functions and come in a multitude of shapes and sizes. This section was designed to help increase your hand tool knowledge. Read the articles to learn about the types of

cutting tools, hammers, measuring tools, pliers, screwdrivers, shaping tools, stabilizing tools and wrenches are available, and what function each one serves. See the following Fig. 1

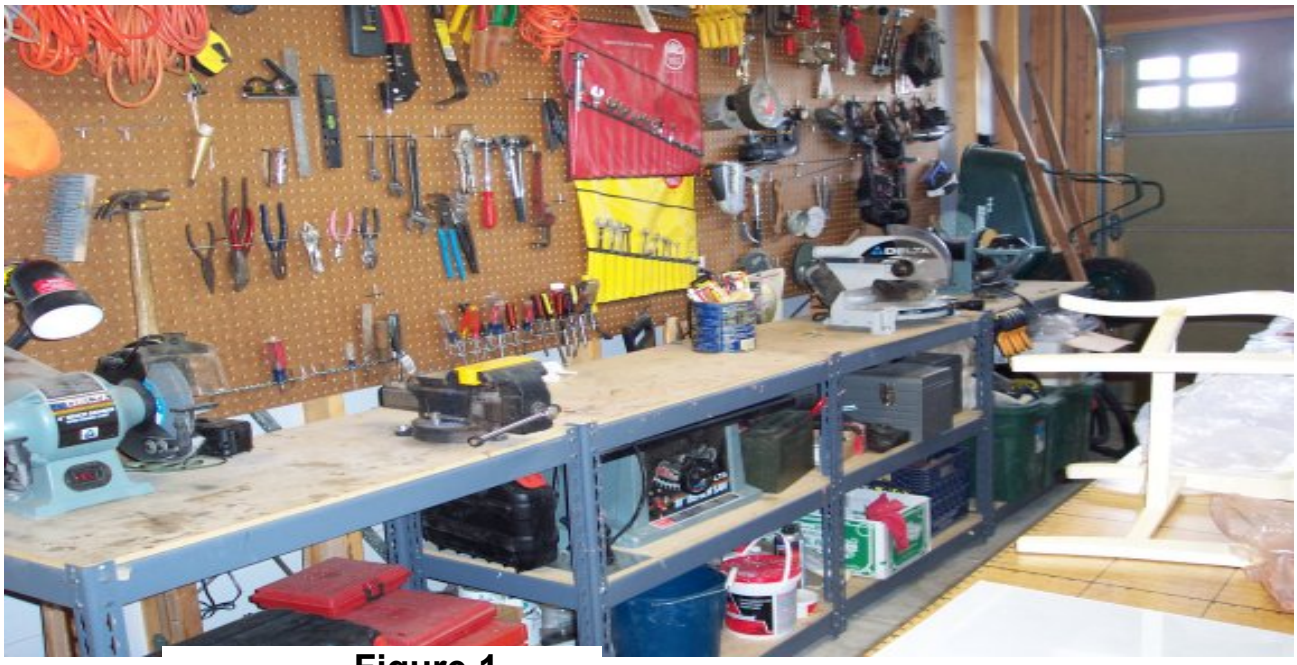


**Figure 1**

## a) Hammers and Saws

A hammer is commonly used for driving nails, but not all hammers. For this purpose the carpenter's hammer or claw hammer is the one that should be use.

Another type of hammer is the MALLET which is used for hammering not nails but the material you are working on. The types of this are; wood, plastic and rubber

These four hammers are the most common in installation construction work. The claw hammer, "ball peen hammers and cross ball peen hammer is used for hammering, shaping metals and pick out nails. And the other is the chipping hammer, used to chip off metal slugs caused by welding process.

A hammer is a necessity in any workshop. The 12 or 16 ball peen hammer is a useful tool. A carpenter's claw hammer may also be needed for mounting any material or fastening sheets of metal or wood. It is important that the hammer head is firmly fastened to the handle. The handle must be also in good condition.

For installation construction work, sometimes you may be able to use this tool but use only appropriate one for the job.

Chipping Hammer

Claw hammer

Mini hammer

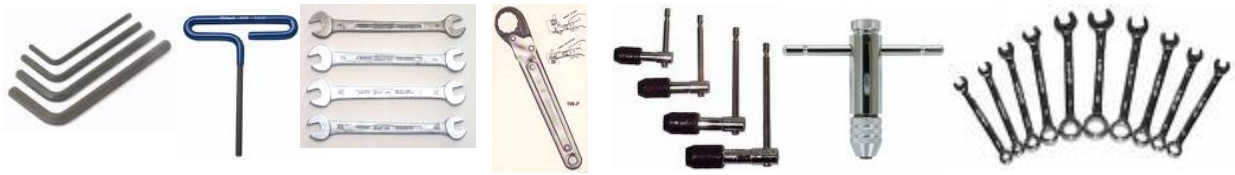
Ball peen hammer

Note

Grasp the handle about two-thirds of the way back from the head. For light, accurate blows, hold the hammer with the index finger on the top of the handle and use wrist action. For heavy blows hold the hammer with fingers around the handle and use elbow muscles

## b) WRENCHES

The following tools are the commonly hand tools being used in electrical works



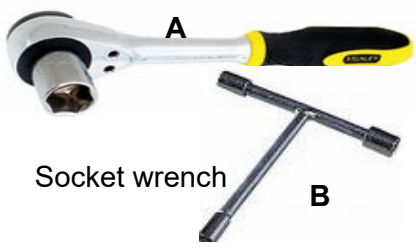
Most technical and servicing work/job requires the use of various types of wrenches. Many fasteners and parts are copper or brass, aluminum and alloy, and therefore, are rather soft. Never use pliers on parts designed to be handled with wrenches.

A service technician or worker needs several types and sizes of wrenches. They should be accurately machined and ground to fit the nut or bolt head accurately and it must fit as much of the hexagon as possible. For the reasons, the wrench types are listed in the order preferred.

- Socket wrenches
- Box wrenches
- Open end wrenches
- Adjustable wrenches

### c) SOCKET WRE CHES

If the nut or bolt head has not enough room around it, the socket is the best wrench to use (A).




A variation of the socket wrench is the nut driver (B). A nut driver is a small direct drive socket wrench. It has a plastic/metal handle that can be used with assorted drive sockets.

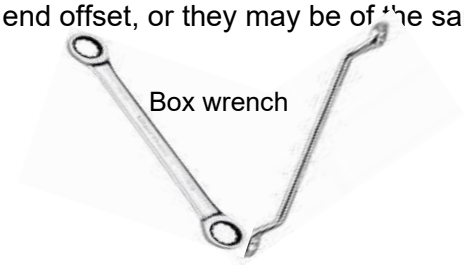
Sockets are now available which will hold the nut or cap screw securely. This is designed to prevent the nut or screw from falling out during alignment and initial threading. This feature is very useful, since a dropped nut or screw can cause problems.

The size marked on the socket corresponds to the diameter of the cap screw or bolt. It is not the distance across the flats as it is with fractional-inch wrenches

### d) BOX WRENCHES

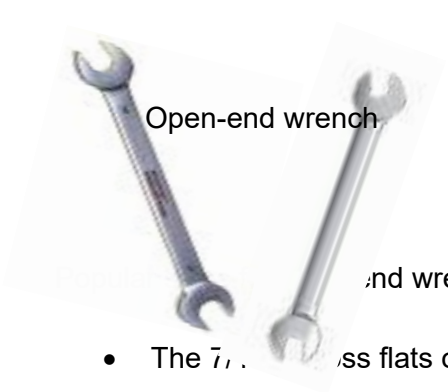
Often, a box wrench can be used in a tight space where a socket wrench cannot go. Box wrenches are usually 12-point and provide a powerful non damaging grip and the nut or bolt,

Box wrenches maybe straight, offset, or double offset. Most box wrenches are double ended. Both may be of the same size with one end offset, or they may be of the same pattern and different sizes.



The size of the wrench opening (across the flats), mark on the wrench. Box wrenches having both flat and handles are necessary for a complete tools kit

## e) OPEN END WRENCHS



Open-end wrench

Open end wrenches can slide on the nut or bolt head from the side. They are used in close spaces on union in other places where the socket wrench and box wrench cannot be used.

An open end wrench should not be used for work if its jaws are spread are burrs. Open end wrenches used in servicing work should have a thick jaw. Thin jaws have a tendency to bite into soft brass and copper parts.

Popular ;nd wrenches are:

- The 7/ . ;ss flats often needed for the ¼" screws and bolts.
- The ½" across flats for 5/16" NC and NF cap screws commonly used on compressor and expansion valves.
- The 5/8" across flats for ¼" flare nuts.
- The 1"across flats which fit the ½" flare nuts. A typical open end wrenches, No.4, is shown in the assortment making up Figure 2-44.
-

Another popular wrench used in work is the combination open end and box socket. Both ends are the same size.

Combination wrench

## f) ADJUSTABLE WRENCH

Often, odd size nuts and bolts are founds in work. Therefore, wrenches with adjustable jaws are necessary in the tool kit. Adjustable wrenches must be kept in good repair. If the wrench does not fit tightly, it may slip and result a ruined wrench, bruised hand, and a ruined nut or bolt head.

A just able wrenched

Forces of the jaws of the wrench should be in the right direction. This will give solid support against both the nut and the body of the wrench

Use wrenches properly so that they fit completely on the nut or bolt. Sockets should be inserted all the way on the nut or bolt head. A loose or worn wrench may slip and spoil the corners on nuts.

## g) HEX KEY WRENCHES

Fold up

L-Keys

Hex wrench

Hex key wrencnes are constructed of alloy steel with a hexagonal (six-point) tip. A common type of hex key is the fold up tool with many key sizes in one handle. Individual L-keys and T-handle hex keys are frequently used for long reach operations, such as set screws on pulleys, rotors and PCB.

Always pull on a wrench rather than push on it. Otherwise, sudden loosening of the nut or bolt may cause a serious hand injury.

A tight bolt or nut may be loosened safely by soaking the treads with the penetrating oil. Heating the bolt or nut may also help. Some service technicians tap a nut be used to loosen corroded treads

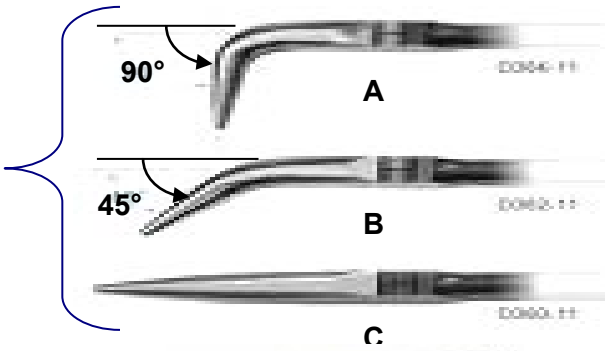
## h) PLIERS

Pliers are universal tools. Pliers are made of alloy steel, usually with manganese, although some are chrome-vanadium steel. Top quality pliers are usually drop-forged. Many different types are available. Use only pliers with insulated handles when working on electrical parts.

- **Gas pliers** are slipping joint combination pliers, which are handy for general use. However they should not be used on nuts, bolts or fittings. They could slip and injure the surface.

- **Cutting pliers** are mostly used when working on wirings. One type is called the lineman's pliers is a powerful cutting and gripping tool. Another type called the diagonal pliers is used to cut in close quarters.
- **Nut pliers** are used to good advantage on some jobs. The jaws always stay parallel. Some have an adjustable cam action that locks the jaws on nuts or bolts, which is often called "vise grip", for having the grip of a bench vise due to the lock cam. In general, it is not good practice to use nut pliers on bolts or nuts. However on a job such as holding a bolt head while turning the nut with a wrench, the use of nut pliers is permissible.
- **Slim-nose pliers, needle-nose pliers, and duckbill pliers** are frequently used in hard to reach places.
- **Round nose pliers** are used to shape wires into loops and to bend sheet metal edges.

These sample tips of long nose pliers are used for hard to reach areas. The angled (90° & 45°) tips are called off-set pliers or "duck billed" pliers. Letter **C** is called the needle tip pliers, because of its thin and long end tip.





Lineman's


Long-nose


Diagonal

Tweezers long nose

A. Mechanical pliers
B. Interlocking joint

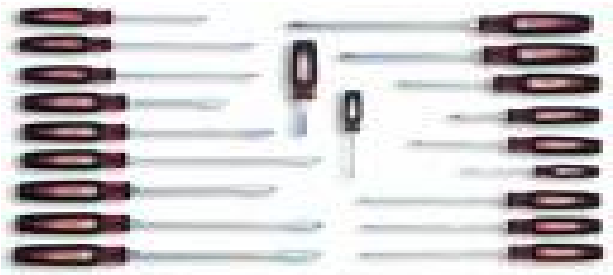
Long neck – long nose pliers


Off-set pliers

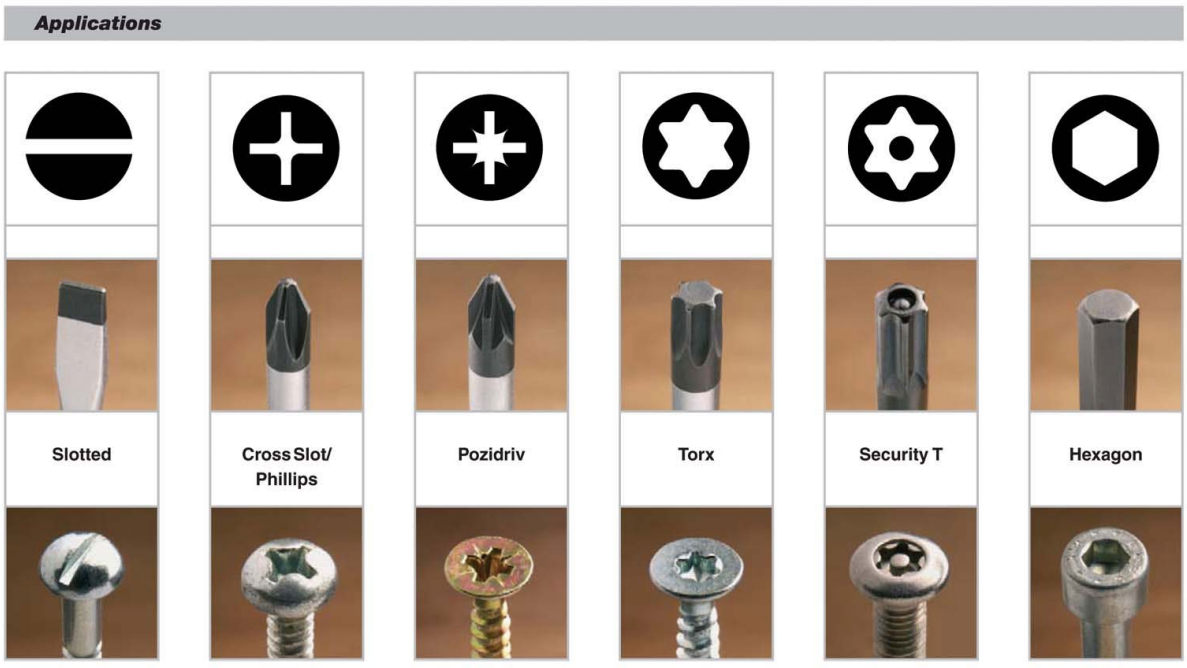

Mini pliers/jewelers pliers

## i) SCREWDRIVERS

A complete set of screwdrivers is very necessary both for installation and shop work. The length of screwdrivers is measured from the blade tip to the handle. Handles are not measured. The recommended average sizes are 2 ½", 4", 6", and 8". There are also longer sizes of screwdrivers for special work operations.



The types of screwdrivers are named for the shape of the end of the blade or tip. Most popular is the straight blade, **slot blade** or regular screwdrivers. The screwdriver bit should fit the screw slot snugly. The blade should be wide enough to fill the screw slot end-to-end.

The **Phillips** screw drivers have a tip to which fits a recessed cross in the head of screw. Phillips screwdrivers are available in the 3” size for No. 4 and smaller screws: the 4” size for No 5. to No 9 screws, the 5” size for No 10 to No. 16 screws, and the 8” size for No. 18 screws and larger.


**Stubby** (Short) screwdrivers are available for working in small spaces. Some screwdrivers are equipped with a clip that holds screws while starting them. Better quality screwdrivers have strong handles firmly bonded to the blade. Plastic handles are popular.

An **offset** screwdriver is necessary in electronics work. There are many places where it alone can be used.

**Special types of screw drivers**

Never use a hammer to pound on a screwdriver. If the screwdrivers are needed for heavy service, use one with a solid steel handle.

## j) VISES

Sturdy machinist’s vises are necessary in the shop. They are particularly convenient for holding parts while drilling, filling, or assembling.

One vise should be large enough to hold most compressor bodies. A special pipe vise, which has a hack saw blade slot, is useful for a large service shop. This blade slots allow accurate cutting of piping and tubing.

Always use soft jaws made of sheet copper or aluminum when clumping a part which must not be marred. These are available in inserts which fit over regular vise jaws.

Machinist Vise

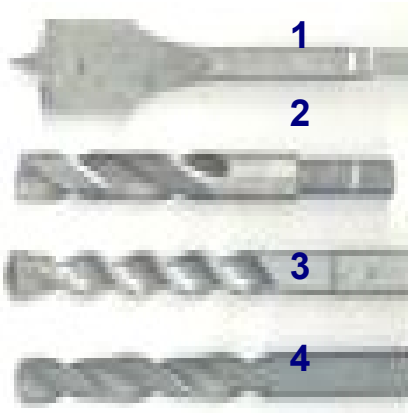
Bench Vise

Swivel Vise

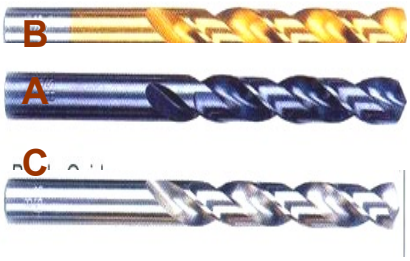
Drill Press Vise

## k) DRILLS & TWIST DRILLS

Twist drills are frequently used for installation and repair work. Drill designs are available for working metal, wood, plastic, and masonry. Twist drills may be turned by drill presses, portable electric drills, or hand braces.

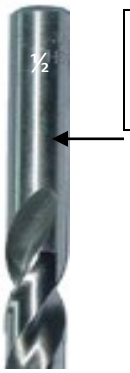



Most commonly twist drills, have straight shanks. This means that the section gripped by a three jack chuck is straight and perfectly cylindrical in shape. Split joint twist drills are often used with portable electric drills because they penetrate many metals easily.




1. **Boring bit**
2. **Drill bit for wood**
3. **Drill bit for concrete**
4. **Drill bit for meta**

**A. Titanium Coated**
**B. Black oxide**
**C. Bright finished**



The shank of twist drills carries a stamped identification giving the kind and sizes of the drill.

Drills are sized by bit diameter. Those intended for working metal come in three different set sizes. Identification for systems for sizes includes fractional numbers, whole numbers, and letters.

Fractional sizes are comes in sets usually beginning with 1/16” and going up into, 1/2”. Drill Bit Sizes: (2) 1/16", 5/64", 3/32", 7/64", 1/8", 9/64", 5/32", 11/64", 3/16", 13/64", 7/32”, 15/64”, 1/4", 5/16”, 3/8”, 1/2".

Number sets begin with No 1 and range trough No 80 (.228”-.0135”).The higher the number, the smaller the drill. Most commonly used size is No.1 through No. 60.

Letter size twist drills are larger than ¼” in diameter in vary from .234” for the “A” size to .413” for the “Z” drill.

Note that the numbered twist drills cover a range of sizes- approximately .013” through ¼” to nearly ½”. These two twist drills sets are often used as top drills in making holes for inside treads. They provide a greater range of sizes than fractional inch twist drills.

Speed of drilling depends upon the type of a material being drilled and the diameter of the hole. In general, the smaller the twist drills the faster it should be turned.

Most twist drills have two cutting edges or lips. These edges must be sharp and equal in length. They also must have a clearance and rake angles.

Twist drills must have flute whish remove chips from the hole. Most flutes are spiral at an angle which automatically provides a rake angled for the cutting edges

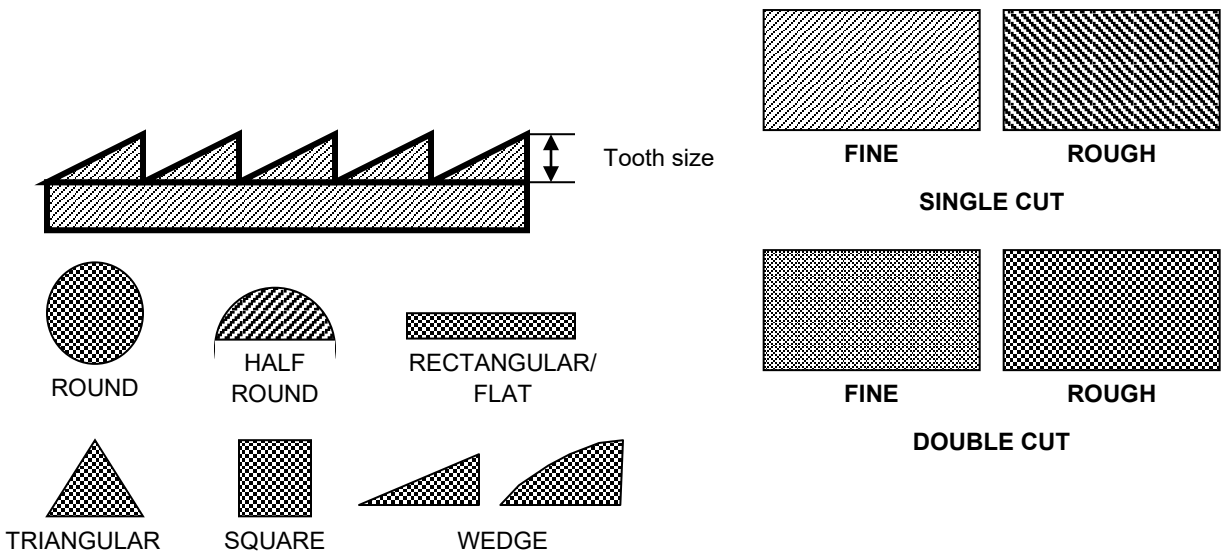
Always be sure the drill is cutting when it is being used. If the cutting edges are just rubbing against the stock, they will quickly heating up. Overheating will destroy the hardness of the drill.

To ensure that the drill forms the correct size whole both cutting lips must be exactly the same length and angle. If one lip is longer, the hole being drilled will be oversize. If one lip has a smaller angle it will do all the cutting and soon grow dull.

Always wear safety glasses to protect eyes from flying chips when using either a drill press or portable drill.

## l) FILES

Various sizes and types of files are needed for cleaning metal surfaces and shaping metal parts. They are classified according to tooth size, shape, and the numbers of directions the teeth are cut on the file.




Files are either single or double cut. The single cut is used for finishing surfaces and double cut for fast metal removal.

Files come in different lengths: 4”, 6”, 8”, 10”, 12” and so on. The size of the teeth varies from dead smooth, smooth, second cut, bastard, to course. Thus, a second cut 12” file has coarser teeth than a second cut 6” file.

Many file shapes are available. They include rectangular, half round, round, triangular, square, wedge shape, and so on

Use file brushes and file cards to clean file teeth which quickly become filled with metal. If clogging material is not removed, the files become useless. Do not use a file card for any other purpose than file cleaning. The bristles may become clogged with dirt.

FILE BRUSH

## A. SAWS

Saws are used for cutting and for other work requiring cutting. The commonly used saw for working are the wood saw and hack saw for metal cutting. Blades are available with different numbers of teeth per inch. For hack saw, blades with 14 teeth per inch are used for soft metal and wide cuts; 18 teeth per inch for medium soft metals; 24 teeth per inch for general work; and 32 teeth per inch for thin metal, tubing or hard metal. A thinner and/ or harder metal will require a blade with more teeth per inch.


A hacksaw blade should not be stroked faster than 60 strokes per minute. Most blades are made of high carbon

steel, and their cutting edges (point) are very sharp and very small. Too rapid use will cause these points to overheat and loose temper

Always lift the blade slightly on the back stroke. This helps the cutting edges sharp. If the blade is not lifted, chips may roll between the work and the cutting edge of the blade, dulling the teeth.

With most blades, the teeth are hardened while the back of the blades is soft and flexible. Some high qualities blades may be made of tungsten or molybdenum steel alloy. It has a high speed steel cutting edge and a die steel flexible backing.

Special hacksaw frames are available for working in small holes. There is also a stub hacksaw blade and an adaptor drive to fit electric drills

## m)TONGS

This a special type of pliers specifically used in metal works, welding or black- smiting. This is used to grip or hold hot metals.


Steel tape/ruler is used for measuring linear measurements

## n) CUTTER/STRIPPER

This tool is used primarily for cutting of papers, cardboards and the like. Also used for cutting or stripping off the insulation of the wire.

Care in handling this tool should always be observed due to the sharpness of the blade.

## o) BR USHEs

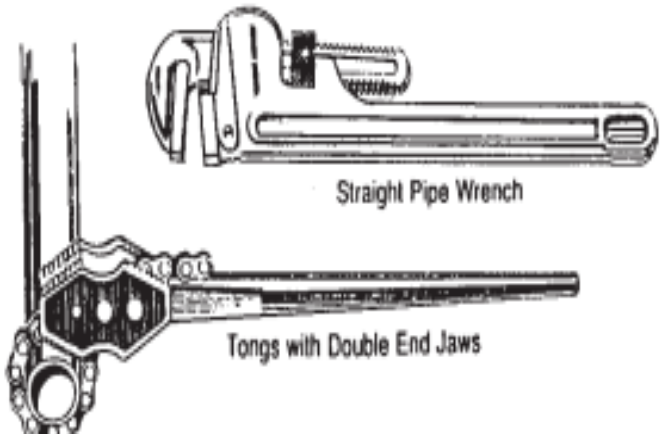
Brushes are used for cleaning parts, spaces/areas of a work project.

Cleaning brushes that should be used must have soft bristles so as not to damage or injure the electronic parts you are working on

But for welding jobs, steel brush is the most common

## p) Pipe wrenches

**Pipe wrenches have been the cause of serious injuries when used on overhead jobs. Wrenches can slip on pipes or fittings, causing the worker to lose balance and fall. Pipe wrenches, whether straight or chain tong, should**



| Self-Check -1 | Written Test-1 |
|---|---|

**Directions:** Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. The tool used for loosening or tightening screws
2. What are the four types of wrenches?
3. The tool used for hammering the materials but not for nails.
4. The tool used for hammering the materials but not for nails.
5. Identify the following screw ends.
6. Write the concept of Continuous quality improvement process

***Note:*** **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

**Answer**

**Score = _____**

**Rating: _____**

Name: _____ Date: _____

**Short Answer Questions**

# OROMIA TVET- BUREAU

## NTQF Level - I

# Learning Guide -2

**Unit of Competence: - Use Construction Hand and Power Tools**

**Module Title: Using Construction Hand and Power**

**LG Code: CON ICW1 M08 LO2- LG-2**

**TTLM Code: CON RCW1 M04 TTLM 0519v1**

## LO2: Select appropriate hand tools

| Instruction Sheet-2 | Learning Guide #-2 |
|---|---|

This **learning** guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Selecting appropriate hand tools
- Checking serviceability of hand tools
- Apply safety
-

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, upon completion of this Learning Guide, **you will be able to –**

- Selecting hand tools
- Check serviceability of hand tools
- Applying safety

- **Learning Instructions:**

8. Read the specific objectives of this Learning Guide.
9. Follow the instructions described in number 27 to 30.
10. Read the information written in the “Information Sheets 2”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
11. Accomplish the “Self-check 2” **in page31 -.**
12. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 2).
13. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #2
14. Submit your accomplished Self-check. This will form part of your training portfolio.

| Information Sheet-2 | CONTENT-2 |
|---|---|

## 2.1 Selecting appropriate hand tools

Hand tools refer to the small materials used for working, commonly by using your hand and with the force of your arm, wrist or hand.

Some hand tools vary according to its use or purpose. Some are categorized depending on its purpose. Categories may be classified into:

- Cutting tools
- Hammering tools
- Leveling Tools
- Measuring tools
- Driving tools
- Holding tools
- Crimping tools
- Boring/drilling tools
- Driving tools
- Cleaning tools
- Shaping tools
- Stabilizing tools
- Bending tools
- And other functions

The flowing hand tools are selected for installation construction work

**Hammers**

- Ball peen hammer
- Chipping Hammer
- Claw hammer
- Mini hammer

**WRENCHES**

- Socket wrenches
- Box wrenches
- Open end wrenches
- Adjustable wrenches

**HEX KEY WRENCHES**

**PLIERS**

- Lineman's pliers
- Long-nose pliers
- Mechanical pliers
- Interlocking joint
- Nut pliers (vise grip
- Off-set pliers
- Mini pliers/jewelers pliers
- Tweezers long nose
- Long neck – long nose pliers
- Long neck – long nose pliers

**SCREWDRIVER**

- Phillip
- Stubby
- offset
- Special types of screw drivers
- Flat screw driver

**HAMMERS**

- Chipping Hammer
- Ball peen hammer
- Claw hammer
- Mini hammer

**VISES**

- Machinist Vise
- Bench Vise
- Swivel Vise
- Drill Press Vise

**DRILLS & TWIST DRILLS**

- Boring bit
- Drill bit for wood
- Drill bit for concrete
- Drill bit for metal
    - Titanium Coated
    - Black oxide
    - Bright finished

**FILES**

- Tooth Size

- Round
- Half Round
- Single Cut
- Rectangular/ Flat
- Triangular
- Square
- Double Cut

**MALLETS**

- Wood
- Leather
- Rubber
- Plastic

**SAWS**

**TONGS**

- Steel tape

**CUTTER/STRIPPER**

**CUTTER/STRIPPER**

| Self-Check -2 | Written Test-2 |
|---|---|

**Directions:** Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Identify the hammers
2. Write the operation of electrical drill
3. What is the purpose Of hand tools
4. Write the types of combination pliers
   1. _____
   2. _____
   3. _____
   4. _____
   5. _____

***Note:*** **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

## Answer sheet

**Score = _____**

**Rating: _____**

Name: _____ Date: _____

**Short Answer Questions**

## OROMIA TVET- BUREAU

## NTQF Level - I

# Learning Guide - 3

**Unit of Competence: - Use Construction Hand and Power Tools**

**Module Title: Using Construction Hand and Power**

**LG Code: CON ICW1 M08 LO3- LG-3**

**TTLM Code: CON RCW1 M04 TTLM 0519v1**

## LO3: Use appropriate hand tools

.

| Instruction Sheet-3 | Learning Guide #-3 |
|---|---|

This **learning** guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Personal protective equipment
- Selecting power tools and equipment
- Checking serviceability power tools
- Selecting equipment to support materials
- Positioning materials
- Positioning material for power tool application
- Power tools application processes

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, upon completion of this Learning Guide, **you will be able to –**

- Personal protective equipment
- Selecting power tools and equipment
- Checking serviceability power tools
- Selecting equipment to support materials
- Positioning materials
- Power tools application processes

**Learning Instructions:**

15. Read the specific objectives of this Learning Guide.
16. Follow the instructions described in number 33 to 39.
17. Read the information written in the “Information Sheets 3”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
18. Accomplish the “Self-check 3” **in page 40.**
19. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 3).
20. If you earned a satisfactory evaluation proceed to “Information Sheet 3”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #3.
21. Submit your accomplished Self-check. This will form part of your training portfolio.

## 3.1 Use appropriate hand tools

The **misuse** of hand tools is a common cause of injury in construction. In many cases, the injury results because it is assumed that everyone knows how to use most common hand tools. This is not the case

It is the responsibility of the supervisor and employer to ensure that workers are trained in the safe and proper use of hand tools. This section is intended to provide an overview of hazards and safe practices in selecting and using hand tools.

1) **Hammers, Sledges, and Mauls**
   Hammers are made in various shapes and sizes for specific jobs. They should be selected and used only for the purpose intended.

**2) Ball peen hammer**

These come in a variety of weights up to 3 pounds. Ball peen hammers are designed for striking cold chisels and punches and for riveting, shaping, and straightening metal (Figure 3.1).

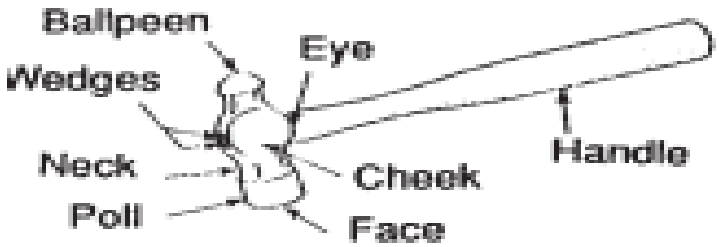



**Fig 3.1**

**3) Sledges**

all patterns of this heavy-duty striking tool have a crowned face with beveled edges. Sledges are forged from high-carbon or alloy steel and are heat treated. The types most commonly used are

- **Double-face** — head weights from 4 to 20 pounds and handle lengths from 15 to 36 inches. The 8-pound sledge is heavy enough for most boilermakers' work, although heavier sledges may be required for fairing tank seams or for driving wedges on heavy plate work. The 4 pound maul or sledge is a favorite with fitters and is often carried on their belts. With a shorter handle (10 to 12 inches) permitting heavy blows with a limited swing, its weight makes it ideal for driving in full pins for lining up

**Fig.3.2**

- **Straight or cross peen sledges** — head weights are from2 to 16 lbs. and handle lengths from 14 to 36 inches. These peens are used for shaping (full erring) and bending metal (Figure 3.3 & 3.4).


Fig 3.3

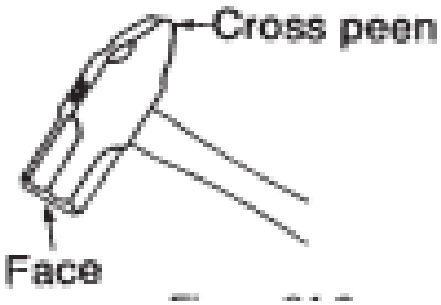



Fig 3.4

- **Chipping hammers** — come in a variety of styles and handles and are designed for chipping slag off welds or burned edges. These hammers have long, slender or tapered points or edges and can be re sharpened many times.
  - **Other types of hammers** — are used when required by the tradesperson. They include carpenters or claw hammers for nailing; various soft-faced mallets, when a steel head might damage the work; and brass or copper heads, when non-sparking tools are required.

    **Basic rules for safe hammer use**
  - Always wear eye protection.
  - Make sure the handle is tight. Never use a hammer with a loose or damaged handle.
  - Always strike the work surface squarely with the hammer face. Avoid glancing blows. Hold the hammer with wrist straight and hand tightly wrapped around the handle.
  - Look behind and above before swinging the hammer.
  - Never use a hammer to strike another hammer.
  - Discard any hammer with dents, cracks, chips, or mushrooming. Redressing is not recommended
  - When striking another tool (chisel, punch, wedge, etc.), the striking face of the hammer should have a diameter at least 1/2 inch (1 cm. +) larger than the struck face of the tool.
  - Never weld or reheat-treat a hammer.

    **Struck or Hammered Tools**

    these include chisels, punches, drift pins, and wedges. General safety measures for their use include:
    1. Always wear eye protection. If other people are close by, put up a screen or shield to protect them from flying chips.
    2. Strike the tool squarely and in the centre, as called for by the crow or beveled-face design. Off-centre blows can misdirect the tool and increase the rate of wear on the b head.
    3. Never use a tool with a mushroomed or chipped head. Remove it from service and destroy or repair it.
    4. Keep cutting edges sharp. Dull edge increases labor and decreases tool durability. Failures can be caused by dullness.

## ➢ Chisels

**Cold chisels** have a cutting edge that will cut, shape, or remove metal which is softer than the cutting edge. Such metals include cast iron, wrought iron, mild steel, bronze, and copper. The hardened cutting edge should be kept sharp at a 60- to 70-degree angle. The selection of chisel is determined by the material to be cut and the size and depth of cut. The most commonly used type is the flat **chisel**. It is used to cut rivets, split nuts, chip castings, cut thin plate, remove burn slag and weld spatter, and cut off small rods and wire. Other varieties of cold chisels include: **cape** – for keyways, grooves, square corners; **half round** and **round nose** – for round grooves and to chip inside corners; and **diamond point** – for V-grooves to remove tubes from sheet and for chipping tack welds and square corners. See Figure 3.5.

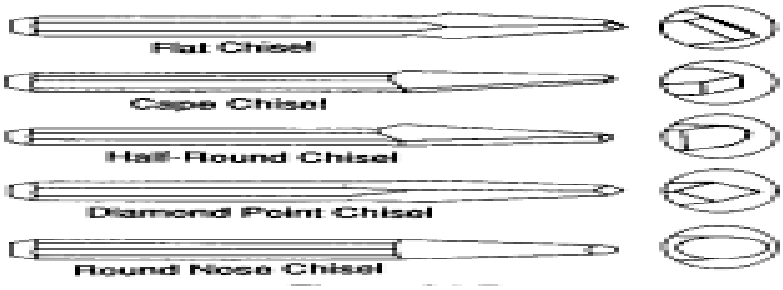



**Fig 3.5**

A sponge rubber pad forced down over the chisel provides a protective cushion that reduces shock for the hand, but a protective guard such as the one shown in Figure 3.6 is more effective.

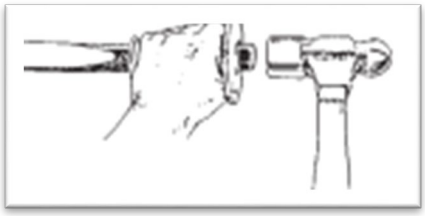


Fig 3.6

**Bull chisels** held by one worker and struck by another require the use of tongs or a chisel holder to guide the chisel so that the user will not be injured (Figure 3.7).

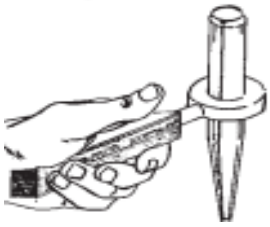


**Fig 3.7**

**Punches and Pins**

- Select punches or pins heavy enough for the work
- Avoid jamming tapered parts of punches in openings.
- Avoid bending or breaking pins.
- Make sure pins or punches are held firmly in position before hitting them, especially on rounded surfaces.

**Hand punches have** a variety of configurations for various purposes. When using punches hold them at right angles to the work surface to prevent side-slipping. Be sure to strike the punch squarely with the hammer to prevent its slipping off and hitting fingers. Figure 21.9a shows some types.

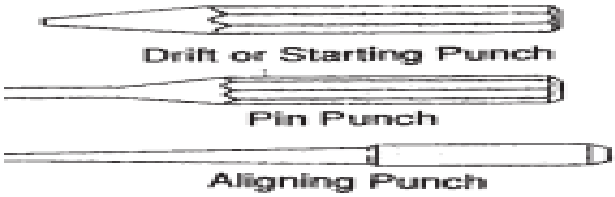



**Fig 3.8**

In addition, there are blacksmith-type punches (not shown), mounted on hammer style handles; a tapered round point, for drifting and aligning; and a straight punch for backing out bolts, rivets, and pins. Drift pins are used to align holes in metal. They come in two types: standard and barrel (Figure
3.9)

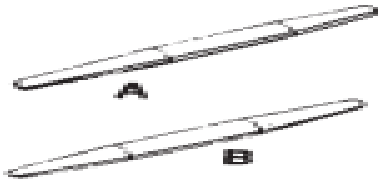



**Fig 3.9**

There are also special pins used largely by boiler makers (Figure 3.10) for heavy-duty steel plate. These include the **poker pin**, a large diameter punch for aligning holes in steel plate; and the **bull pen**, a heavy-duty pin used in the fit-up of steel plate. They are inserted into holes in fit up clamps (welded temporarily to the side of the plates) to align the plates for welding.


**Fig 3.10**

**Cutting Hand tools**

**Bolt Cutters**

Bolt cutters (Figure 3.11) typically come in lengths of 18" to 36" with the larger ones able to cut mild-steel bolts and rods up to 1/2" diameter, as well other materials such as wire rope. With these tools, observe the following.

• Wear eye protection.
• Keep fingers clear of jaws and hinges.
• Cut ends can fly and cause injury. Try wrapping burlap or a rag around the jaws while cutting.
• Keep jaws at right angles to material. Don't pry or
twist — chips can break off and fly, causing injury or damaging the blade.

**Fig 3.11**

**Snips**

Snips (Figure 3.12) are generally used to cut light gauge galvanized sheet metal, copper sheet, and tin. Flying metal particles are always a hazard. Safety glasses or a face shield should be worn to protect against eye injury. Always be sure to select the right size and type of snips for the job. Don't cut wire with snips —use wire cutters.

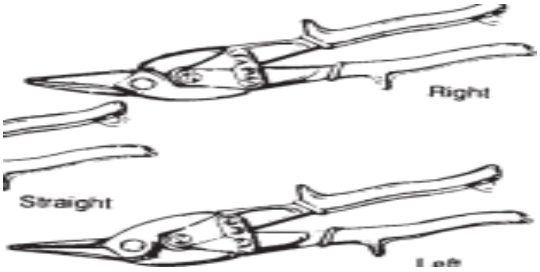



**Fig 3.12**

**Hacksaws**

although power tools will be used whenever possible, hacksaws deserve mention. They fill a gap by cutting metal too heavy for snips or bolt cutters. The main danger from hacksaws is hand injury due to blade breakage. To prevent this danger:

• install and keep the blade taut but not too tight
• make sure that the material is held firmly in a vise or by other devices such as clamps.

Files

There are three standard American-pattern metal file cuts as shown in Figure 3.13.

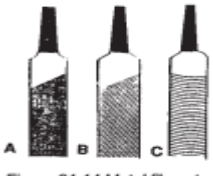



**Fig 3.13**

Make sure that a handle is installed on a file before use. This will prevent the chance of an uncovered tang being jammed into your hand. A firmly attached handle will also improve control of the tool.

**Taps and Dies**

Keep taps and dies clean and well oiled when not in use.

Store taps and dies so that they don't contact each other or other tools. For long term storage coat them with rust preventive compound and store in a dry place.

Don't attempt to sharpen taps or dies. Precise cutting is required to maintain the correct thread cutting characteristics and chamfer. This work must only be done by experienced personnel.

• Don't use diestocks or tap wrenches as hammers or pry bars. *Figure 21.9aTypes of Punches Figure 21.10* Drift *Pins: A Standard; B Barrel*

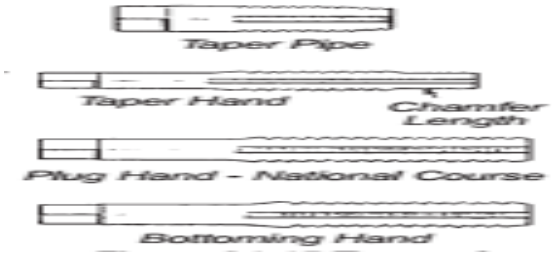



**Fig 3.14**

Use protective equipment that is mandatory on construction sites, operators of quick-cut saws should wear snug-fitting clothing, hearing protection, and eye and face protection, and heavy-duty leather gloves

| Self-Check -4 | Written Test-4 |
|---|---|

**Directions:** Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. The main purpose of **Cold chisels** _____
2. **How many part of Ball peen Hammers** _____
3. Write the types of **chisels**

a. _____
b. _____
c. _____
d. _____
e. _____

***Note:*** **Satisfactory rating - 4 points** **Unsatisfactory - below 4 points**

**Answer sheet**

**Score = _____**

**Rating: _____**

Name: _____ Date: _____

**Short Answer Questions**

# OROMIA TVET- BUREAU

## NTQF Level - I

# Learning Guide - 4

**Unit of Competence: - Use Construction Hand and Power Tools**

**Module Title: Using Construction Hand and Power**

**LG Code: CON ICW1 M08 LO4- LG-4**

**TTLM Code: CON RCW1 M04 TTLM 0519v**

## LO4: Select appropriate power too

This **learning** guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Personal protective equipment
- Selecting power tools and equipment
- Checking serviceability power tools
- Selecting equipment to support materials
- Positioning materials
- Positioning material for power tool application
- Power tools application processes

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, upon completion of this Learning Guide, **you will be able to –**

- Personal protective equipment
- Selecting power tools and equipment
- Checking serviceability power tools
- Selecting equipment to support materials
- Positioning materials
- Power tools application processes

**Learning Instructions:**

22. Read the specific objectives of this Learning Guide.
23. Follow the instructions described in number 43 to 47.
24. Read the information written in the “Information Sheets 4”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
25. Accomplish the “Self-check 4” **in page 48.**
26. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 4).
27. If you earned a satisfactory evaluation proceed to “Information Sheet 3”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #4.

Submit your accomplished Self-check. This will form part of your training portfolio

## 4.1Select appropriate power tools Checking serviceability power tools

### 4.1.1 Select appropriate power tools

**Mini Drill Press**

1. Improvised Mini Drill Press
2. Drill -Grinder
3. Pedestal Drill Press
4. Double Pinion /"Eggbeater" Hand Drill
5. Hand Drill
6. Electric Hand Drill
7. Battery Operated /Cordless Hand Drill
8. Pedestal drill press

Electric drill should be grounded for safety. The metal frame of the drill should be electrically connected to a good ground. Most electric drills are equipped with a three pong grounded plug. If the circuit to which the drill is connected is not provided with a three pong grounded socket, a grounded adaptor should be used. Some hand drills have the electric motor insulated from the case, and do not need grounding.

**a. TYPES OF DRILL MACHINES**

MINI DRILL PRSS
Fig 4.1

IMPROVISED MINI DRILL PRESS

DRILL –GRINDER

Fig 4.3

PRESS Fig 4.4

DOUBLE PINION /"EGGBEATER" HAND DRILL
Fig 4.5

HAND DRILL
Fig 4.6

ELECTRIC HAND DRILL
Fig 4.7

BATTERY OPERATED /CORDLESS HAND DRILL Fig 4.8

- **Mini drill press** – used for drilling small item and PCB for electronic products
- **Improvised mini drill press** – fabricated by copying the original drill press using only the double pinion drill, used for small items that needs a controlled rpm movement
- **Drill - Grinder** – the double purpose machine that can be used for both drilling and grinding
- **Pedestal drill press** - A drill press is a fixed style of drill that may be mounted on a stand or bolted to the floor
- **Double pinion/"eggbeater" hand drill** – the later version of the old hand drill, used for drilling small items and wood
- **Hand drill** – the manually operated drill, used commonly used on wood
- **Electric hand drill** – the boring or holing equipment using electricity for easiness of work and having a faster rpm for faster work
- **Cordless/battery operated hand drill** – used for holing or drilling where electricity is not available, but usually used for screw application.

## 4.2 Selecting equipment to support materials

These materials are used for special purposes and a function, its use is determined according to the work or task to be performed. A tool or device is a piece of equipment which typically provides a mechanical advantage in accomplishing a physical task. The most basic tools are simple machines. For example, a crowbar simply functions as a lever.

The commonly used equipment for welding and installation construction work is the following:

- Drill press (pedestal type)
- Bench Grinder & pedestal type

- Angle grinder
- Power hacksaw
- Welding automatic cutting machine
- Welding positioned
- Lathe machine
- Beveller machine
- Welding machines – SMAW, GMAW, GTAW, FCAW,OAW
- Air compressor

The drill press is commonly used for drilling holes on any material. There are several types of presses, from light to heavy duty, from slow to fast rpm. Drill presses are used to bore holes on metals to create uniform holes. The use of this equipment gives ease in performing the task because both hands may be free from movement.

Fig 4.9 Drill press

The bench and pedestal grinder has many functions in different workshop. For its basic use, the grinder is being utilized for its main purpose, to grind. But by replacing its grinding stone with a buffer piece, it can function as a buffer that is used for cleaning parts of electronic products or jewelleries.


Pedestal grinder Fig 4.10

The air compressor also has many functions in a workshop. It could be as a blower in removing dust and dirt; it could be used for spray painting, or an attachment as part of a special welding or cutting machine (plasma cutter). Using a special blower gun with reverse mode, the blower can be turned into a vacuum piece.


Air compressor Fig 4.11

The air compressor, sometimes called portable grinder, is used for grinding welded materials. It could also be used as a power brush by replacing the disk with wire brush, and then it could be used as a cleaning material for welding.

Air compressor Fig 4.12

The automatic gas cutting machine is used in cutting metal plates and pipes. It could be adjusted in any angle desired. This is commonly used for bevelling plates.

automatic gas cutting machine Fig 4.13

Another type of cutting machine used in welding workshops is the power hack saw. This is a mechanized saw, used to make work (cutting of metals) easier.


Power hack saw Fig 4.14

Bevelling machines come in different types. Some are hand held, and some are big machines. These are used to bevel metals to be welded.

Bevelling machines  Fig 4.15

Welding petitioners are used to properly position the metals to be welded. Circular petitioners are commonly used for pipes.

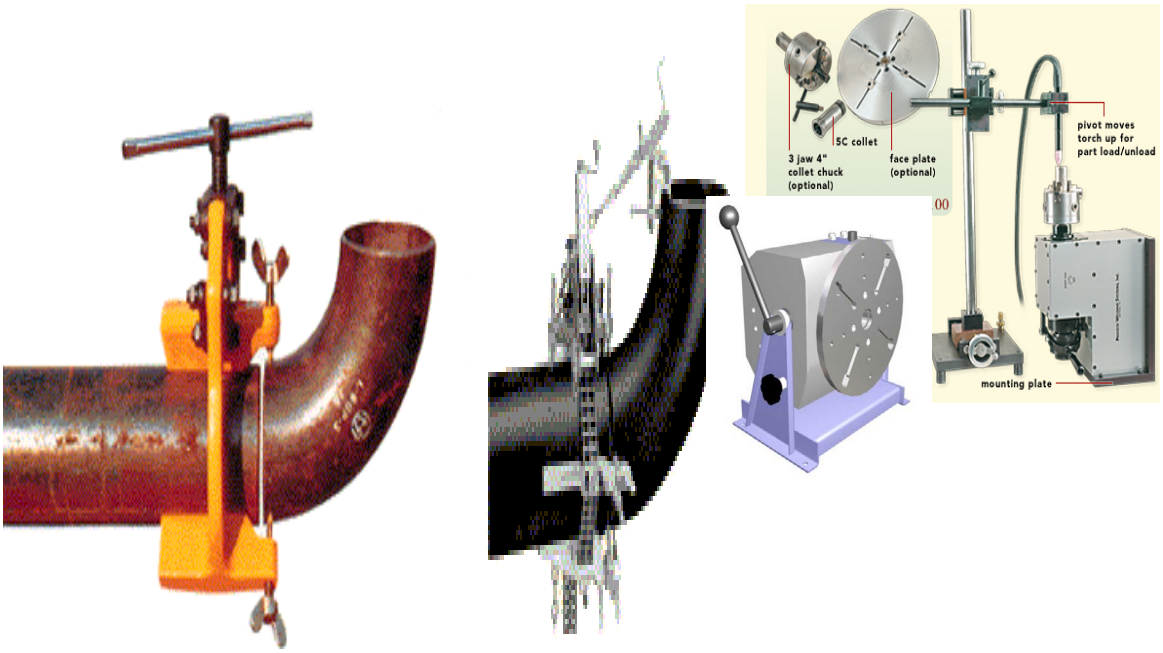



Fig 4.16

| Self-Check -4 | Written Test-4 |
|---|---|

**Directions:** Answer all the questions listed below. Use the Answer sheet provided in the next page:

4. The angle grinder, sometimes called_____
5. The drill press is commonly used for_____
6. Write the commonly used equipment for welding and installation construction work

f. _____

g. _____

h. _____

i. _____

j. _____

***Note:*** **Satisfactory rating - 4 points** **Unsatisfactory - below 4 points**

## Answer sheet

**Score = _____**

**Rating: _____**

Name: _____ Date: _____

**Short Answer Questions**