Carpentry

Level-II

Learning Guide-23

Unit of Competence: use carpentry hand and power tools

Module Title: using carpentry hand and power tools

LG Code: EIS CRP2 M06 LO2-LG-23

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LO2: Identify and select hand, power and pneumatic tools

Instruction Sheet	Learning Guide #23

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

- Identifying and selecting Hand, power and pneumatic tools, EPT,
- Recognizing and adhering OHS requirements
- Checking Lubricants, hydraulic fluid and water
- Checking & using EPT for operation according to manufacturer specifications

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**:

2.1. Identify and select. Hand, power and pneumatic tools, EPT their functions, operations and limitations

2.2. Recognize and adhere to OHS requirements for using hand, power and pneumatic tools.

2.3. Check Lubricants, hydraulic fluid and water according to manufacturer recommendations.

2.4. Check EPT for operation according to manufacturer specifications and safety (OHS) requirements for use of EPT.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, up to Sheet 4”.
4. Accomplish the “Self-check after each information sheet respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet**.**
6. Do the “LAP test” (if you are ready).

Information Sheet-1	Identifying and selecting Hand, power and pneumatic tools, EPT

2.1. Identifying and select Hand, power and pneumatic tools, EPT

- **Hand tools**

Carpentry hand tools have been used for hundreds of years and, in many cases, their basic design has changed very little. They can be divided into three categories:

- ✓ Hand (manual)
- ✓ Power (electrical and battery)
- ✓ Pneumatic (compressed air).

These days, carpenters tend to use power and pneumatic tools, because they're faster and require less physical effort. However, having a selection of hand tools available and knowing how to use them is important as there may be occasions when a power source (electricity or compressed air) is not available, or a job has a particular detail that requires the use of a hand tool. In this section, we'll look at the main types of hand tools you'll be using for your Carpentry tasks. In addition to what's covered in this guide, your lecturer will take you through hand tools training in the workshop.

Fig 1. Hand tools

- **Types of hand tools**

Hand tools can be divided into categories, each with a specific function or purpose. In this section, you'll look at tools in the following categories:

- ✓ measuring and marking out
- ✓ saws
- ✓ impelling
- ✓ planes
- ✓ chisels
- ✓ shaping
- ✓ boring
- ✓ holding and supporting
- ✓ setting out
- ✓ levelling.

- ✓ **Measuring tools**

The first step in almost every carpentry project is being able to correctly transfer measurements from working drawings or plans onto the materials being used. There are many measuring devices available and the appropriate tool will depend on the type of work

being carried out. Measuring and marking out are generally carried out at the same time; however, we'll look at them separately for now as the tools used for each are quite specific.

- ✓ **Retractable tape measure**

Retractable tape measures have a built- in coil spring which automatically retracts the blade into the casing when it's released. They're used mostly by site carpenters but can also be useful on larger joinery projects. There are a variety of sizes available but the most common are 2-5 m.

Fig 2. Tap rule

- ✓ **Wind-up tape measure**

Wind-up tape measures are used for measuring long distances, eg when setting out buildings. Their blades can be made of steel, plastic or linen and they are available in a variety of sizes (20–100 m). Wind-up tapes are retracted manually.

Fig 3. Wind up Tap rule

- ✓ **Steel rule**

Steel rules are used mostly in joinery workshops, rather than on building sites, but are useful for a range of carpentry work. They are generally available in lengths from 150 mm to 1 m

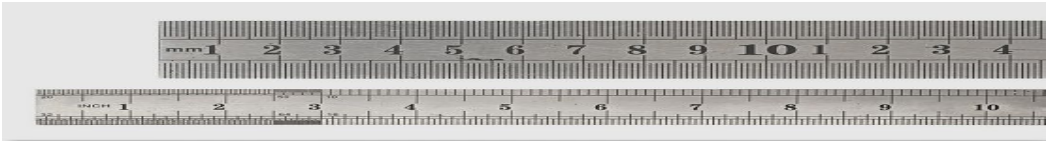


Fig 4. Steel rule

- ✓ **Folding rule**

Folding rules are used mostly in joinery workshops. They can be made from hardwood or plastic and are generally available in 1 m lengths. Markings are placed at 1 mm, and numbers are written every 10 mm. These days, folding rules have been largely replaced by retractable tape measures and steel rules..

Fig 5. Folding rule

- ✓ **Marking out tools**

As you measure materials, you mark the cutting points, lines and angles. Marking out tools include squares, bevels and gauges which are used to determine the angles and straight edges required, and pencils, spurs and knives that create the actual marks.

- ✓ **Squares and bevels**

Squares and bevels are used by carpenters to mark guide lines on timber at an angle. The square or bevel a carpenter chooses to use usually depends on the angle required for the cut.

- ✓ **Try square**

Try squares are used to mark out lines at 90° to the face and/or edge of a piece of timber. They consist of two parts:

- The 'stock' which is held against the side of the timber to position the square
- The 'blade' which provides a straight edge to draw the lines.

Try squares are precision tools used mostly in joinery workshops where tasks require greater accuracy or finer detail.

Fig 6. Try square

- ✓ **Miter square**

Miter squares are similar to try squares in that they have a stock and a blade; however, the blade on a miter square projects from both sides of the stock to form angles of 45° and 135°, allowing a carpenter to mark out lines on timber at these angles. Miter squares are used mostly in joinery workshops.

Fig 7. Miter squares

- ✓ **Try/miter square**

Mostly used in joinery workshops, this square is a combination of the try square and the miter square. While this tool can be used to mark out an accurate line at 90° to the Face/edge of a piece of timber, the top inside corner of the stock is cut to an angle of 45° for marking out lines at that angle. As the stock on the try/mitre square is slightly shorter in length (due to the 45° angle), you must take care to hold the stock firmly against the timber to avoid unintended movement.

Fig 8. try/ Miter squares

- ✓ **Combination square**

Combination squares are used mostly for site carpentry and are very versatile. They can be used as a square or miter square and have additional features such as a scribing spur and a spirit level that allow them to be used for a number of other functions.

Fig 9. combination squares

- ✓ **Sliding bevel**

Sliding bevels are used to set out lines at any angle other than 90°. They have a stock with an adjustable blade which is set to the required angle and then locked with a thumb lever. Sliding bevels are used in both joinery workshops and site carpentry.

Fig 10. Sliding bevel

- ✓ **Gauges**

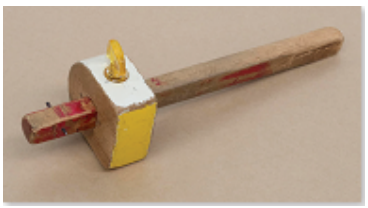
Gauges are used to scribe (scratch) lines along the length and/or width of timber. There are three types of gauges that you'll use in carpentry, and each has been designed for a specific purpose.

- ✓ **Marking gauge**

Marking gauges are used to scribe a single line along the grain of the timber parallel to the edge. They consist of a stock, a beam and a spur (a pointed steel pin that creates the mark on the timber). Marking gauges are commonly used in both joinery workshops and site carpentry.

- ✓ **Mortise gauge**

Mortise gauges are similar to marking gauges but they have two spurs instead of one. The distance between the double spurs can be adjusted to produce parallel gauge lines along the grain of the timber. Mortise gauges are used in joinery workshops to mark out mortise and tenon joints (a common 90° joint used for corners and framing), hence the name.



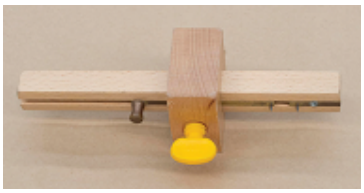


Fig 11. Marking guages

- ✓ **Cutting gauge**

Cutting gauges are different from other gauges in that they're designed to scribe a parallel line across the grain of the timber. They have a knife edge rather than a spur to allow the fibres in the grain to be severed. Cutting gauges can be used to mark out dovetail joints.

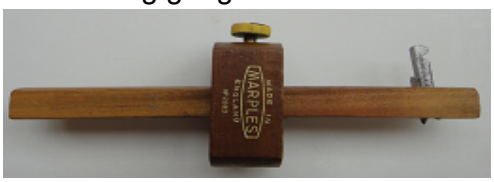


Fig 12. Cutting guages

- ✓ **Knives, scribes and pencils**

There are a variety of other tools you can use to mark, scribe or cut lines on timber to provide yourself with an accurate guideline to follow. These are an essential part of any carpenter's toolkit.

- ✓ **Marking knife**

Used mostly in joinery, marking knives are for cutting lines across the grain of timber. They can be very accurate when sharpened correctly (on one side only) but you must take care as lines cannot be easily erased if you make a mistake.

Fig 13. Marking knives

- ✓ **Utility knife**

Utility knives are multi-purpose and have a retractable blade. In carpentry, these knives are used mostly for cutting plasterboard.

Fig 14. Utility knife

- ✓ **Scribe**

Similar to marking knives, scribes are also used to mark lines across the grain of timber. They have a sharpened point rather than a blade. They're good for marking out where pencil lines may be hard to see, like on dark timber such as jarrah.

Fig 15. Scribe

- ✓ **Carpenter's pencil**

Carpenter's pencils are large pencils which contain rectangular lead. These pencils produce a thicker line than ordinary pencils and are ideal for marking out on sawn (rough) timber. Primarily used for site carpentry, their large size and shape make them unsuitable for use on joinery work where finer detail is required.

Fig 16. Carpenters pencil

- ✓ **Saws**

Because of the availability of power saws these days, hand saws are being used less and less. However, carpenters still need to be proficient in the use of hand saws as there may not be a power source on some construction sites, or it may be quicker and more efficient to use a small handsaw for some jobs. Saws can be split into two groups:

- Traditional hand saws – used for larger timber sections
- Back saws – used for smaller detailed work.

Hand saws are classified by their purpose, the length of their blade, and the size and shape of their teeth. Saw teeth size is measured by the number of teeth in a 25 mm length of blade.

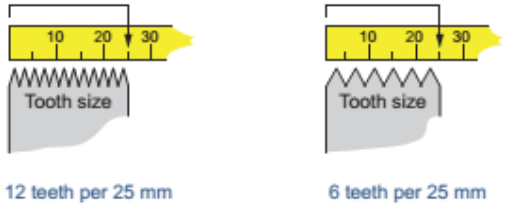


Fig 17. Saw teeth size

Note: Saw teeth sizes are sometimes referred to as TPI because saw teeth were originally measured in 'teeth per inch'. An inch is a unit in the imperial system of measurement that was used in Australia before the conversion to the metric system in the 1970s. The imperial system is still used in the USA, where many tools are manufactured. An inch is approximately 25 mm, which is how that measurement came to be used to determine saw teeth size in Australia.

- ✓ **Rip saw**

Rip saws have teeth with a square faced edge (like a chisel) and are used to cut timber along the grain, ie in the direction the fibers run. They're the largest of the hand saws and are available in lengths up to 750 mm with 3–6 teeth per 25 mm.

Fig 18. Rip saw

- ✓ **Crosscut saw**

As the name suggests, crosscut saws are used to cut timber across the grain. Their beveled teeth have a sharper cutting edge than a rip saw, allowing them to cut the fibers of the grain. They're available in lengths up to 650 mm and have 6–8 teeth per 25 mm.

Fig 19 . cross cut saw

- ✓ **Panel saw**

Panel saws are generally used to cut sheet materials such as plywood and particle board. They are available in lengths up to 550 mm, and have 10 teeth per 25 mm.

Fig 20. Panel saw

- ✓ **Back saws**

Back saws have a steel or brass strip on the back of the saw which stiffens the blade so that straight lines can be cut more accurately. The three most commonly used back saws are the:

- tenon saw
- dovetail saw
- gent's saw.

- ✓ **Tenon saw**

Tenon saws, as the name suggests, were designed primarily to cut tenon joints. However, they can also be used to cut other types of carpentry joints, mouldings and beads (lengths of shaped timber). Tenon saws are generally 250 mm and 350 mm long and their teeth size is 10–14 teeth per 25 mm.

Fig 21. Back (tenon) saw

- ✓ **Dovetail saw**

Smaller than the tenon saw and with finer teeth, the dovetail saw is primarily designed to cut dovetail joints used in joinery. However, they can also be used to cut mouldings and beads. Dovetail saws are generally between 200–250 mm long and their teeth size is 16–20 teeth per 25 mm.

Fig 22. Dovetail saw

- ✓ **Gent's saw**

Gent's saws are the smallest of the back saws and are used primarily for small detail work. They're between 100–250 mm long with up to 32 teeth per 25 mm.

Fig 23. Gent saw

- ✓ **Miscellaneous saws**

There are a number of other saws used by carpenters which have been designed for specific purposes. These include the:

- coping saw
- hacksaw (including the junior hacksaw)
- keyhole saw.

- ✓ **Coping saw**

Coping saws have a very narrow blade which is tensioned by a spring frame. They're used primarily to cut curves in timber, but they can also be used to cut away waste in joints like dovetails and bridles.

Fig 24. Coping saw

- ✓ **Hacksaw and junior hacksaw**

Hacksaws are designed for cutting metals. Blades are available with 14, 18, 24 or 32 teeth per 25 mm. The larger teeth are used for cutting softer metals such as aluminum and the finer teeth for harder or thinner metal sections. The junior hacksaw is a smaller version of the hacksaw and is used for cutting smaller metal components.

Fig 25. Hack saw

- ✓ **Keyhole saw**

Traditionally, keyhole saws were designed for cutting keyholes in doors (as the name suggests). Sometimes referred to as a pad saw, they're commonly used on site for cutting holes (for electrical sockets, light fittings, etc) in plasterboard walls and ceilings.

Fig 26. Keyhole saw

- ✓ **Impelling tools**

Impelling tools are those that drive or push something. They include hammers, mallets, Screw drivers and nail punches.

- ✓ **Hammers**

Hammers are used for a variety of purposes in construction, including driving nails, pins and pegs into surfaces, and for demolition. They're available in many shapes and sizes. The hammers the carpenter requires depend on the type of task being undertaken.

- ✓ **Claw hammer**

The main purpose of the claw hammer is to drive nails into timber with the claw on the back of the hammer used to extract nails. Claw hammers are available with timber, steel or fiber

glass handles. Timber- handled hammers are best suited to joinery work and the stronger steel and fiber glass types are more suited to on-site use.

Fig 27. Claw hammer

- ✓ **Warrington hammer**

Warrington hammers are small and lightweight, and used for smaller nails such as panel pins (thin nails used for mouldings). They're also known as tack hammers.

Fig 28. Warrington hammer

- ✓ **Club hammer**

Club or lump hammers are heavier hammers with a variety of uses including driving small wooden pegs into the ground (for setting out buildings, etc), striking cold chisels and for light demolition work.

Fig 29. Club hammer

- ✓ **Sledgehammer**

Sledgehammers are very heavy hammers used to drive large wooden pegs into the ground (for setting out buildings, etc) and for heavy demolition work. They generally have a longer handle than most hammers. This enables the operator to put more energy into the 'swing' motion for heavier work.

Fig 30. Sledge hammer

- ✓ **Miscellaneous impelling tools**

Carpenters may also include the following impelling tools in their toolkits for more specialized tasks.

- ✓ **Mallet**

Mallets are used primarily to strike wood chisels, although they can also be used to assemble joinery components such as window and door frames.
Mallets have two main components – a head (generally hard rubber) and a shaft which is generally made from a hard-wearing timber such as beech.

Fig 31. mallet

- ✓ **Nail punch or centre punch**

Nail punches are used (with a hammer) to drive the heads of nails below the surface of timber for a neater finish. The nail hole can then be filled before painting or varnishing.
Similar to the nail punch is the centre punch which is used to punch a small mark into materials such as timber or steel before drilling. Its tip is more pointed than the nail punches.

Fig 32. Nail punch

- ✓ **Pincers**

Pincers are used to remove small nails where the use of a claw hammer is restricted. The handle has a built-in claw, which can be used to prise up the head of the nail to ease its removal.

Fig 33. Pincer

- ✓ **Wrecking bar or pinch bar**

Wrecking bars have a number of uses, including the removal of larger nails from timber and as a lever in the demolition or dismantling of a structure or building.

Fig 34. Wrecking bar

- ✓ **Screwdrivers**

Screwdrivers are available in many different sizes with a variety of tips (the shape of the head). Screwdriver tips are sized and shaped to suit the drive of the screw. Traditional screwdriver tips include the following.

Slotted head	Phillips head	Pozidriv®
		
These have a conventional straight screwdriver blade. They are less common nowadays, because they are difficult to drive with a powered screwdriver.	These are self-centring and the driver is less likely to slip off the head when it's being driven.	These are similar to Phillips heads but have slightly different shaped slots which allow more torque to be used without 'slipping out'. This allows them to drive the screw more tightly.

Square drive	Torque head
	
These screwdrivers have a square drive that allows the screw to be placed on the driver before driving (without falling off). They allow greater tightening of the screw with a powered driver.	Similar to a square drive, these screwdrivers have a star-shaped drive that allows greater tightening of the screw with a powered driver.

Fig 35. Screw drivers

- ✓ **Hand Planes**

Despite the widespread use of electrical power planes these days, no carpenter's toolkit is complete without at least one or two hand planes. Hand planes fall into two major categories bench planes and block planes. The difference is the direction of the bevel of the cutting iron (the part of the plane that does the planning).

- On bench planes, the bevel always faces down.
- On block planes, the bevel always faces up.

The angle of the cutting iron means that bench planes are designed to plane with the grain (the direction of the fibers in the timber), while block planes are designed to plane end grain or against the grain of the timber.

- ✓ **Bench planes**

There are three types of bench planes you'll use most frequently, as shown here.

Smoothing plane	Jack plane	Try plane
		
Smoothing planes are 250 mm in length. These shorter bench planes are useful for planing timber to create a smooth surface to prepare the timber for its final finish, eg paint, varnish.	Jack planes are slightly larger at 350 mm in length and are used for dressing timber (planing to size) and fitting doors, window sashes, etc.	Try planes are the biggest of the bench planes at 450–600 mm in length. They're used primarily to straighten the edges of boards in an operation known as 'jointing'.

Fig 36. Hand planes A

- ✓ **Block planes**

Block planes are used for cutting rather than smoothing. The three most common types you'll use are shown here

Block plane	Shoulder plane	Bullnose plane
		
Block planes are small hand planes which typically have the iron bedded at a lower angle than other planes, with the bevel up. They're designed to cut end grain and are usually small enough to be used with one hand.	Shoulder planes have a blade that finishes flush with the edges of the plane, allowing trimming right up to the edge of a work piece. They're used primarily to trim the shoulders and faces of tenons.	Similar to shoulder planes, bullnose planes are designed to plane right into corners of joints or frames. The blade is positioned almost up to the end of the plane's body and consequently very little material is missed in a corner while planing.

Fig 37. Hand plane B

- ✓ **Specialist planes**

Some jobs will require the use of a specialist plane. Three types of specialist planes are shown here.

Rebate plane	Side rebate plane	Bench rebate plane
		
Rebate planes (also known as rabbet planes) are hand planes designed in wood.	Side rebate planes perform a similar function to rebate planes but with the blade set on the side of the plane. They're used to ease the side of grooves or, in other situations, where a conventional plane is unable to reach.	Bench rebate planes are the largest of the rebate planes and are used for planing larger rebates in doors, window frames, etc.

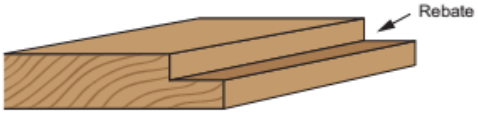


Fig 37. Special planes B

- ✓ **Chisels**

Chisels, like planes, are designed to remove timber using a sharp cutting edge. There are several types of chisels and each has been designed to suit particular tasks. They're available in a range of sizes, depending on the type; however, common width sizes are 6 mm, 10 mm, 13 mm, 19 mm and 25 mm.

- ✓ **Firmer/ Flat chisel**

Firmer chisels are general purpose wood-cutting tools with a rectangular section blade. The blade has parallel sides and tapers slightly from the handle to the cutting edge.

Fig 38. Firmer/flat chisel

- ✓ **Beveled edge chisel**

Beveled edge chisels are nearly identical to firmer chisels; however, their blades are beveled on the top face of the two long sides, and sometimes the top as well. The beveled edges allow the chisels to be used to work undercuts such as dovetail housing. It reduces the rigidity of the blade, making it suitable only for lighter carpentry work.

Fig 39. Beveled edge chisel

- ✓ **Paring chisel**

Paring chisels can be either of the firmer or the beveled edge type; however, the blade is much longer – approximately 175 mm – enabling it to be used to pare (chisel) long housings such as those found in stair or shelf construction

- ✓ **Mortise chisel**

Mortise chisels are used for chopping out joints or chiseling away waste wood. They're usually used for cutting mortise joints (slots in timber), because they're strong enough to withstand heavy blows with a mallet.

Fig 40. Mortise chisel

- ✓ **Gouge chisel**

Gouge chisels are similar to conventional chisels except that their blades are curved in cross- section, not flat. They're available with two different types of blade – those with the cutting bevel ground on the outside, known as 'out cannel' and used for hollowing out timber and carving, and those ground on the inside known as 'in cannel' and used for scribing concave surfaces.

Fig 41. Gouge chisel

- ✓ **Cold chisel**

Although cold chisels are not woodworking tools, most carpenters will have one in their toolkit. They're used with a mallet to chip away bricks, concrete and masonry

Fig 42. Cold chisel

- ✓ **Shaping tools**

Shaping tools are usually used to finish or clean up shaped surfaces. They let you make fine changes to the size and shape of articles created in a variety of materials including timber, metal, plastic and gypsum (plasterboard).

- ✓ **File**

Files are steel bars with a case-hardened surface and a series of sharp, parallel teeth on all sides. They're used to remove fine amounts of material from timber, metal and plastic objects. Files are available in various shapes and sizes including flat, square, round and triangular. Carpenters usually have an assortment of files in their toolkit

✓ **Rasp**

Rasps are coarse files with sharp, raised, pointed teeth. As they have larger clearance between teeth, they're usually used on softer, non-metallic materials such as timber.

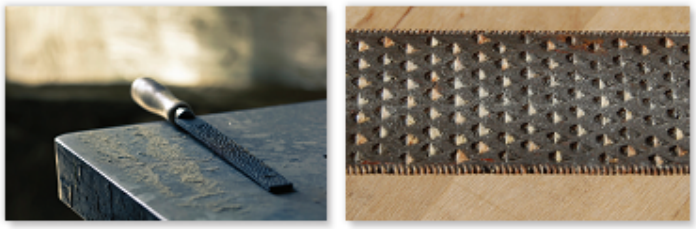


Fig 43. Rasp file

✓ **Spoke shave**

Spoke shaves are similar to planes and have short soles that enable them to work on concave (curving in) and convex (curving out) surfaces. They're used for the final working and cleaning up of curved edges. Spoke shaves should be pushed rather than pulled. There are two types of spoke shave:

- Flat soled which can be used for planning narrow edges and convex curves
- Round soled for convex curves

Fig 44. Spock shaves

✓ **Boring tools**

Boring tools are used to bore or drill holes in materials such as timber, metal and plastic. With the increasing availability of portable power tools, particularly battery powered drills, the use of manual boring tools like hand drills and ratchet braces is becoming less common. However, they are still a useful addition to any carpenter's toolkit, as there may be occasions when there is no power source available.

✓ **Hand drill**

Hand drills (also known as wheel braces) used to be an essential part of every carpenter's toolkit. They were used for boring (drilling) holes up to 6 mm in diameter. Hand drills have generally been replaced now by cordless (battery powered) drills.

Fig 45. Hand drill

- ✓ **Ratchet brace**

Ratchet braces (also known as sweep or bit braces) are very useful, versatile tools which can be used to drill holes anywhere, as they do not need electricity to power them. They rely solely on applied pressure and the turning of a handle. The brace has a built-in 'ratchet' which enables it to be used in tight corners or confined spaces.

Fig 46. Brass drill

- ✓ **Auger bit**

Auger bits are used with ratchet braces to bore larger holes in timber. Sizes generally range from 6–38 mm. Auger bits have a central threaded worm which draws the bit into the wood, while the spur on the cutters scribe the cut which outlines the hole.

Fig 47. Auger bit

- ✓ **Holding and supporting tools**

You'll often need to hold or support timber while it's being cut, or keep components together during the assembly, such as the screwing or gluing together of doors, frames, cabinets, etc. The tools used for this purpose are called holding and supporting tools, and you'll most likely have a good collection of different types of these that you'll use regularly.Let's look at a few of the most common.

- ✓ **Sash clamp**

Sash cramps consist of a straight steel bar with a fixed head at one end and an adjustable slide at the other. They're generally used in pairs in the final assembly of joinery work to provide the pressure required to hold the joints on frames together until they're secured by either wedges or the setting of adhesive

Fig 48. Sash clamp

- ✓ **G clamp**

G clamps are general purpose clamps used to clamp items before and after assembly. Their name comes from the shape of the clamp which has a curved frame and straight screw head resembling the letter 'G'.

Fig 49. G clamp

- ✓ **F clamp or quick release clamp**

The F clamp (also known as a quick release clamp) also takes its name from its shape. The F clamp is similar to a G clamp, but it has a wider opening capacity (throat). F clamps are ideal for clamping timber to a workbench or saw stool, or temporarily holding items such as kitchen cabinets together before a more permanent fixing can be made.

Fig 50. F clamp

- ✓ **Vice**

Vices are holding devices that are fixed in position on the side of a workbench. They're used to hold timber securely, allowing you to use both hands when completing tasks such as sawing, chiseling, planning, sanding or filing.

Fig 51. Vice

- **Power tools**

As a carpenter you'll be required to work with a range of tools, plant and equipment. These tools will vary in type, purpose, make and model but you must consider WHS requirements for every tool you use. Safety is the most important consideration when you're selecting and using any tools, plant or equipment. If you choose the wrong tools or use them in an unsafe manner, it can result in an injury or accident. Power tools are particularly dangerous, because they run at high speeds and/or pressure and can cause very serious injuries. Before you get to the power tools section of this guide, you'll be looking at safe working practices and how to implement them to ensure your own safety and that of other workers. Your lecturer will also take you through some safety training in the workshop. Some of power tools used for carpentry works are mentioned as follows:

- ✓ **Portable electric saw**

It is a power-driven rotary cutting tool, which is principally used for cutting boards and for making angular cuts. It's size is determined by the diameter of the largest blade it will take. Most carpenters prefer a 7 or 8 in. diameter saw blade. The depth of cut is adjusted by raising or lowering the position of the base or shoe. The portable electric saw may be used to make cuts in assembled work. For example, flooring and roofing boards are often nailed into place before ends are trimmed.

Fig 52. Portable electric saw

- ✓ **Portable electric plane**

It is a power-driven rotary cutting tool, used for planning wooden surfaces and edges. The depth of cut is adjusted by raising or lowering the front shoe. The rear shoe (main bed) must be kept level with the cutting edge of the cutter head. The power plane is equipped with a fence that is adjustable for planning bevels and chamfers. For surfacing operations, it is removed.

Fig 53. Portable electric plane

- ✓ **Portable power drill**

It is a motorized rotary driving tool, used for drilling purpose. It comes in a wide range of types and sizes. The size is determined by the chuck capacity. Cordless portable drills are handy for many jobs. power is supplied by a small nickel-cadmium battery that can be recharged. Such drills are used for general maintenance work and on production jobs where there are no power lines.

Fig 54. Portable electric drill

- ✓ **Portable power router**

It is a power driven shaping tool, used to cut irregular shapes and for producing a variety of patterned work pieces. When they are equipped with special guides, they can be used to cut dados, grooves, mortises, and dovetail joints.

Fig 55. Portable electric router

- ✓ **Portable sander**

It is a power driven abrading tools, used for sanding (smoothing) wooden surfaces. It includes three basic types;

a. Belt,
b. Disc
c. Finish portable sander.

The size of the belt and disc sander is determined by the width of the belt and the diameter of the disc respectively. Portable finishing sanders are used for final sanding where only a small amount of material needs to be removed. They are also used for cutting down and rubbing finishing coats. There are two general type of portable finish sander; Orbital and oscillating.

Fig 56. Portable electric sander

- ✓ **Jigsaw**

Although jigsaws cut more slowly than circular saws, they can cut curved shapes into materials such as timber, metal and plastic. They're commonly found in joinery workshops but can also be useful on site for cutting holes in, for example, kitchen worktops for sinks.

Most models now have a variable speed control so that you can select the best speed for the job. Fast speeds are more suitable for cutting timber and slower speeds for cutting metal. The base plate of a jigsaw can be tilted to allow beveled cuts. The teeth of a jigsaw point upward, so the cutting is done during the up-stroke. This can result in damage to the surface of the timber, especially on sheet materials such as plywood. If necessary, clearance must be allowed for the edges to be cleaned up afterwards There are blades available with teeth which point downwards and these are useful when cutting material such as plastic laminates. However, you must take extreme care when using this type of blade as it can cause the saw to 'lift' away from the work surface. To prevent this, always maintain downward pressure on the saw

Fig 56. Jig saw

Self-Check -1	Written Test

Directions: Match column A with column B for all the questions listed below. Use the Answer sheet provided in the next page:

Column A	**Column B**
1. Manually used	A. Pneumatic tools
2. Electrically operated	B. PPE
3. Compressed air operated	C. Hand tools
4. Explosive power tools	D. Generator
5. Personal protective equipment	E. EPT
	F. Power tools

Note: **Satisfactory rating - 3 and 5 points** **Unsatisfactory - below 3 and 5 points**

You can ask you teacher for the copy of the correct answers.

Copy right: Federal TVET Agency

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Matching Questions

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------

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Information Sheet- 2	Recognizing and adhering OHS requirements

2.2. Recognizing and adhering OHS requirements

- **OHS requirements for using hand and power tools**

As a carpenter you'll be required to work with a range of tools, plant and equipment. These tools will vary in type, purpose, make and model but you must consider WHS requirements for every tool you use. Safety is the most important consideration when
you're selecting and using any tools, plant or equipment. If you choose the wrong tools or use them in an unsafe manner, it can result in an injury or accident. Power tools are particularly dangerous, because they run at high speeds and/or pressure and can cause very serious injuries. Before you get to the power tools section of this guide, you'll be looking at safe working practices and how to implement them to ensure your own safety and that of other workers.

- **Working with power tools**

The following are some important tips for you when you're working with power tools.

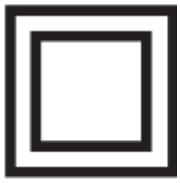
- ✓ If you don't know how to operate a tool safely, don't use it. Power tools in particular should be used only by fully trained operators.
- ✓ Choose the correct tool for the job and identify its limitations before you start any task.
- ✓ When using power tools, it's important that you're alert at all times. Never use a tool if you're tired, unwell or under the influence of drugs or alcohol.
- ✓ Be aware of your surroundings, the limitations of your work area and the presence of other people.
- ✓ Never disturb anyone who is using a power tool. Wait for them to finish what they're doing before trying to attract their attention.
- ✓ Keep the working environment clean and tidy, and make sure there is adequate lighting.
- ✓ Always wear the correct PPE when using any tools, plant or equipment.

- **Electrical safety**

Although there are other power sources available for carpentry tools, eg batteries and compressed air, electricity is still the most commonly used power source within the construction industry. Electricity is extremely dangerous and can cause serious injury or death, not just to the operator but to others working nearby. When you're working with

electricity, you must choose tools with appropriate safety features. You must maintain their condition and use safe work practices at all times.

Most modern power tools are ‘double insulated’. This means that they have two layers of insulating material (usually plastic) between the live components and the operator. These tools do not require an earthing wire (used to divert electricity away from the operator and into the earth), so they’re fitted with a two pin plug or a plug that has a third unconnected pin to help hold the plug in the power point. Double insulated tools are identified by this symbol.



Note: You should avoid older power tools (made before 1980) as they do not have the required safety features. Many were made with metal housings and may not have proper earthing. If you’re not sure, ask a qualified electrician to check the tool for you.

- **Extension leads, plugs and sockets**

All power tools have cables which need to be plugged into a 240 volt power supply. Extension leads are often used to allow tools to be operated at various locations around a work area. You must take particular care to protect these cables and leads from being damaged or becoming a hazard to others working nearby.

Keep the following important tips in mind when you’re working with cables and extension leads.

- ✓ Always keep the extension lead of a power tool over your shoulder so that it’s well away from cutters, blades or other equipment.
- ✓ Never carry or lower a power tool by its cable, and never disconnect a power tool by pulling on the power cable. Always disconnect by removing the plug.
- ✓ Don’t use extension leads while they’re coiled up, as they can get very hot if they’re tightly coiled when current is running through them.
- ✓ Don’t try to repair damaged extension leads yourself. Repairs should be carried out by a licensed electrician only.
- ✓ Electric tools and extension leads must have clear or moulded plugs and sockets so that any damaged connections can be seen. Sockets on extension leads must also have an extended rim or shroud to prevent anything getting into the gap between the plug and socket and touching the live pins.

- ✓ Never allow traffic such as wheelbarrows or vehicles to run over power cables or extension leads. Protect cables and leads with timber or suspend them overhead.
- ✓ Make sure power cables and extension leads are not a trip hazard.

- **Battery powered tools**

Battery powered tools (often referred to as cordless tools) are becoming more popular with a wide range of tools now available. Although these tools are relatively safe to use, you should consider the following safety issues.

- ✓ Lithium batteries are deemed hazardous, because they can overheat and ignite under certain conditions.
- ✓ Always store batteries in cool, dry conditions. They should never be allowed to become too hot or to freeze.
- ✓ Batteries should only be recharged with a compatible battery charger. Allow discharged batteries to cool down before recharging.
- ✓ Battery chargers are plugged into a 240 volt power source and should therefore be tested and tagged by a qualified electrician.
- ✓ Rechargeable batteries contain hazardous materials and should not be placed in the rubbish bin. They should always be disposed of at a recycling centre.

- **Pneumatic power**

Pneumatic tools are powered by air or gas under pressure rather than electricity. The compressed air is transferred to the tool from an air compressor by hose and is expelled with significant force. Compressed air tools should be used only by fully trained operators.

Bear in mind the following when you're using a pneumatic tool.

- ✓ Do not attempt to disconnect compressed air hoses unless they are protected by a valve (a device that regulates the flow of air).
- ✓ Do not use compressed air hoses to clean away sawdust or other waste material from the work area, as flying debris can cause serious injury.
- ✓ Compressed air hoses must never be directed towards yourself or others, as the air is dispersed at a very high pressure. Air blown under the skin, eg into an open wound, can result in infection, or even stroke or heart attack.
- ✓ Traffic such as wheelbarrows or vehicles should never be allowed to cross air hoses, because the extra pressure on the hose can damage the compressed air equipment.
- ✓ Do not allow air hoses to become a trip hazard.

- **Moving parts**

All power tools have moving parts which can be very dangerous, because the operator, the tool's power cable or the material being worked on can be caught and drawn into hazardous positions. Depending on the tool, there are risks of cutting and crushing injuries.

The following are some general safety tips for all power tools.

- ✓ Always keep the extension lead of a power tool over your shoulder so that it's well away from cutters, blades, etc.
- ✓ Avoid wearing loose clothing and jewelry including chains, bracelets and rings.
- ✓ Long hair should always be tied back.
- ✓ Keep materials clear of moving parts until the tool has reached full speed.
- ✓ Never put a power tool down until the rotating parts have come to a complete stop.

- **Stability**

When you're using tools, plant and equipment, you should always remain in full control of the machine. To achieve this, it's important that you follow these safety procedures.

- ✓ Where possible, always use two hands on the machine.
- ✓ Stand with your feet in a stable position and avoid overstretching.
- ✓ Avoid using power tools in hazardous weather conditions such as strong winds and rain.
- ✓ Take extra care when you're working in awkward positions, confined spaces or at heights.
- ✓ Always clamp work pieces securely to stop them from moving.

- **Guards**

All power tools have features built into them for your protection. Guards cover moving parts and cutting blades so that you don't come into contact with these hazards. It's extremely important that you inspect safety features before use to ensure they're working correctly.

- ✓ Tying up or removing guards or safety devices is very dangerous and may be a breach of WHS law.
- ✓ Never use a tool if the guards or any safety features are missing or damaged.

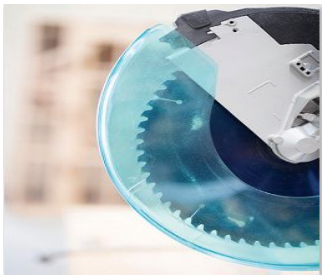


Fig 57. Guard

- **Emergency stop buttons**

Most modern larger power tools and machinery now have an emergency stop button usually a large, red button near the main controls of the tool or machinery. If you press this button, you will immediately cut power to the tool or machine.

Fig 58. Emergency stop

- **Cutting hazards**

Carpentry tools are designed to cut through a variety of materials including timber and metal, so it's vital that you take care when using these tools as they can easily cut through skin and bone. Remember the following when you're working with carpentry tools.

- ✓ Keep tools sharp. A sharp chisel is less likely to cause an accident than a blunt one.
- ✓ Never place any part of your body in the path of a blade or cutting edge or on any part of the tool that can't be seen.
- ✓ Keep your finger off the switch or trigger of a power tool until you're fully prepared to start cutting.
- ✓ Remember that the cutting edge of a power tool is still a hazard even when the power is off. You must take care when changing blades or performing maintenance.
- ✓ Don't carry sharp tools or blades in your pockets. You must take extreme care when you're carrying sharp tools or handing them to others.
- ✓ Replace covers or caps on tools when they're not in use.

- **Noise**

Excessive noise can damage hearing. Some tools, plant and equipment can be very noisy, so there are many situations where you'll need to wear hearing protection. You should always wear earmuffs and/or earplugs when you're operating power tools or in any situation where you have to shout to be heard by someone just a meter away.

Self-Check -2	Written Test

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

1. All power tools have cables which needs to be plugged in to a ---------- power supply
   A. 180 volt
   B. 240 volt
   C. 500 volt
   D. 1500 volt
2. Which of the following are relatively safe to use
   A. Battery power tools
   B. Electrical machine
   C. Electrical power tools
   D. Explosive power tools
3. Pneumatic tools are powered by the following except
   A. Gas
   B. Electric power
   C. Air
   D. None of the above

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

You can ask you teacher for the copy of the correct answers.

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Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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Information Sheet-3	Checking Lubricants, hydraulic fluid and water

2.3. Checking Lubricants, hydraulic fluid and water

To keep tools and equipment operating smoothly and to prevent jamming, you must lubricate them to reduce wear on their moving parts.

You can do this by using one of the following procedures.

In-line lubrication:- This system has a reservoir of oil in the air line between the receiver and the tool. As the air passes across the reservoir, a mist of oil is drawn into the air stream and passes through the tool as it's used.

Manual lubrication:- This is done by simply dropping a few drops of oil into the inlet end of the tool. Use only approved oil that comes with the tool or is recommended in the manufacturer's guide

Fluids—particularly diesel fuel, diesel exhaust fluid (DEF), engine and transmission oil, hydraulic fluid and coolant are machine's lifeblood.

These fluids require exceptional care, especially as equipment continues to be manufactured with sophisticated technologies.

- **Requirements for using lubricants are:-**

1. Read the Manual

When it comes to maintaining and selecting equipment fluids, follows the manufacturer's Operation & Maintenance Manual. The manual explains in detail the machine's maintenance points and lists suggested fluid intervals and recommended original equipment manufacturer (OEM) fluids.

Make sure your operators also follow instructional decals and safety measures outlined in the manual. Some manufacturers strategically place decals with the recommended service intervals on heavy construction equipment. Ideally, you and your operators should request proper maintenance training from your local equipment dealer, and familiarize yourself with decals and key maintenance points on machines.

2. Follow Storage Procedures

When storing diesel fuel, oils, coolants and hydraulic fluids, the last thing you want is water, dust and debris in your storage tanks. These contaminants can degrade a fluid's chemical structures and lead to pump, filter and injector problems. All machine fluids should be handled in a dedicated fluid containment area and stored in a manner that maintains a maximum level of cleanliness.

When handling fuel, oils and fluids, make sure to follow these general best practices.

- Any fluid entering a storage tank should pass through a dispensing filter.
- Keep fluids tightly closed in a dry, well-ventilated place.
- Carefully reseal open containers and keep them upright to prevent leakage.
- Always observe label precautions and follow safe handling procedures.
- Wear protective equipment to reduce the oils and fluids that are absorbed into skin and to keep components clean.

Be cautious when storing DEF to help reduce contaminants such as dirt and dust when working in earthmoving applications. Try to fill the DEF tank directly from the DEF container. If you are using a funnel or intermediate containers, make sure they're clean and only used for DEF. Contamination can damage the catalyst in your selective catalytic reduction system and cause you to use more DEF than is needed. Purity is critical, so work with a local dealer to better understand how to store and handle DEF. Every 6 months, you or a professional diesel fuel cleaning and inspection service should test supply tanks for contaminants. If significant amounts of water or sludge are found, the entire tank should be drained and cleaned. To help monitor your supply tank, maintain a preventive maintenance log that includes maintenance history, filter changes and particle counts.

3. Evaluate Delivery Methods

Getting equipment serviced in the field using clean, contaminant-free fluids is critical to avoid damaging machine parts and critical system components, resulting in machine downtime and shortened component life.

Fortunately, fluid distributors and mobile lubrication vehicles can provide you with a choice of efficient fluid delivery methods. They offer a clean, dirt-free environment that can successfully reduce contaminants that might otherwise be introduced into machine components. Depending on what fluids are needed, the distributor or dealer will determine which type of mobile lube vehicle best fits your operation.

4. Develop a Proactive System

To best identify minor issues before they become major repairs, develop a proactive maintenance program executed by trained service technicians. Addressing issues during regular maintenance helps to avoid the domino effect—triggered by a machine breakdown—that forces downtime and results in rush-rate repairs.

One of the biggest advantages to utilizing dealership service teams is having trained technicians with access to the latest information, resources and tools. They can complete calibrations and check diagnostics with tools and software that are typically not available to customers. Machines equipped with telematics allow your dealership to monitor machine activity and location, and they provide visibility to machine hours, so you can properly schedule maintenance.

5. Consider Fluid Analysis

Finally, protect your equipment with a fluid analysis program. Some manufacturers offer a program that will test small samples of engine oil, transmission oil and coolant to identify the

overall condition of the fluids as well as any contaminants. The report can give you a heads-up on machine condition.

By following these simple steps, you can prolong component life, reduce maintenance costs and keep your equipment running successfully on the jobsite.

Self-Check -3	Written Test

Directions: Say True for the correct and False for the in-correct for the questions listed below. Use the Answer sheet provided in the next page:

1. Lubrications is applied on non moving parts of tools and equipment
2. Manual lubrication is applied simply dropping a few drops of oil in to the inlet end of the tools
3. In using of fluid and oils wearing protective equipment is not mandatory action

Note: **Satisfactory rating 2 points** **Unsatisfactory - below 2 points**

You can ask you teacher for the copy of the correct answers.

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Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-4	Checking & using EPT for operation according to manufacturer specifications

2.4. Checking & using EPT for operation according to manufacturer specifications

- **General requirements of EPT**
  - ✓ Workers who pick up an explosive-actuated tool must immediately prove to themselves that the tool is not loaded. This action must become instinctive and be carried out before anything else is done with the tool. Even after watching someone else handle the tool before passing it on, make sure that it's not loaded.
  - ✓ Explosive-actuated tools should be used, handled, and stored properly.
  - ✓ Never put your hand or fingers over the end of the muzzle for any reason, even when the tools are not loaded with fasteners.
  - ✓ Tools must be inspected and function-tested before work starts. Proper training and the operator's manual will describe how to carry out both of these requirements.
  - ✓ Operators must be trained on the explosive actuated tools they are using and must wear all the required personal protective equipment.
  - ✓ Firing explosive-actuated tools from ladders is not recommended. From a ladder, it can be difficult to press the tool muzzle against the base material with enough pressure to fire while maintaining three-point contact with the ladder. Consider using a platform ladder or scaffold. For tasks overhead or at heights, work from a scaffold or another approved work platform to ensure solid, balanced footing. As an alternative, use a manufacturer's pole accessory if the reach is normal ceiling height (8–10 feet). The pole secures the tool and permits firing by the operator standing below.
  - ✓ Do not leave the tool unattended unless it's locked in a box.
  - ✓ Load the tool immediately before firing. Don't walk around with the tool loaded.
  - ✓ Do not use explosive-actuated tools in areas where there may be exposure to explosive vapors or gases.
  - ✓ Fasteners should not be fired through pre-drilled holes for two reasons.

1) Unless the fastener hits the hole accurately, it will probably shatter the edge.

2) The fastener derives its holding power from compressing the material around it.

A predrilled hole reduces this pressure and therefore the fastener's holding power. (This is why studs and pins driven into steel should penetrate completely through the metal. Otherwise the compressed steel trying to regain its original position can loosen the fastener by pushing against the point. With the tip completely through the metal the same pressure only works to squeeze the pin tighter.)

- **Maintenance**

Tools in regular use should be cleaned daily. Tools used intermittently should be cleaned after firing. All parts of the tool exposed to detonation gases from the cartridge should be cleaned and lightly oiled according to the manufacturer's instructions. The cartridge magazine port, cartridge chamber, and piston sleeve should be wiped clean but never be oiled. The tool brush supplied is adequate for most cleaning tasks. Stubborn carbon should be loosened with a manufacturer's spray detergent oil. Tools being checked for immediate use should be wiped dry of oil. Failure to clean the tool as recommended can lead to corrosion, pitting, fouling, and failure to work properly. Ideally, the tool should be cleaned before being returned to storage.

Tools with a power control adjustment will accumulate additional powder residue from firing especially when the control is set to restrict the amount of cartridge strength being used. Semiautomatic tools may also accumulate powder residue. These tools need to be cleaned more often. Sluggish performance may indicate that a tool needs cleaning. Tool action will slow to the point where a competent operator can detect the difference. Most manufacturers recommend major maintenance, inspection, and cleaning every six months. This involves stripping, inspecting, and cleaning parts not covered in daily maintenance.

- **Storage requirements**

Regulations require that both the tool and the cartridges be stored in a locked container with explosive loads of different strengths in separate containers. Cartridges should only be removed from the locked container when they are going to be used immediately.

- **Regulations**
  - ✓ Any worker using an explosive-actuated tool must be instructed in its safe and proper use.
  - ✓ Before using the tool, the operator must check to ensure that it is in good working order. This means inspection and function testing.
  - ✓ Tools firing fasteners at a velocity of more than 90 metres/second must have a protective guard at least 75 mm in diameter, mounted at right angles to the barrel of the tool and centered on the muzzle end of the tool, if practical.
  - ✓ The tool must require two separate actions before it will fire:

1) Pressure against the surface of the material
2) Action of the trigger.

• Explosive-actuated tools must be stored in a locked container when not in use or when left unattended.

• The tool must not be loaded until ready for immediate use.

• Whether loaded or unloaded, the tool must never be pointed at anyone.

• Cartridges must be marked or labelled for easy identification. Cartridges of different strengths must be stored in separate containers.

• Misfired cartridges must be placed in a container of water and be removed from the project.

Lead Exposure There is the potential for overexposure to lead when using explosive actuated fastening tools in indoor applications with poor ventilation. Hands and skin may also become contaminated by lead. This could lead to ingestion if skin is not covered and hands are not washed.

- **Controlling Lead Exposure**

1. Consider alternative fastening methods such as gas-powered systems.
2. If you must use explosive-actuated tools, follow the Ministry of Labour's Guideline "Lead on Construction Projects". Some recommendations for the operator include:

• The guideline recommends at least an N95 respirator. However, refer to the manufacturer's specifications to determine if the respirator can protect against lead.
• Wear protective clothing such as gloves and coveralls.
• Wash hands with soap and water before breaks, eating, drinking, or smoking, and do not chew gum.
• Never take contaminated work clothes home.

If you suspect that you are suffering symptoms from lead exposure, see your family doctor and ask for a blood test to determine the presence of lead. Lead contamination in the human body can accumulate over time. It also takes the body time to expel this lead after exposure

Self-Check -4	Written Test

Directions: Say True for the correct and False for the in-correct for the questions listed below. Use the Answer sheet provided in the next page:

1. Explosive actuated tools must be stored in locked container
2. Firing explosive actuated tools from ladder is recommended
3. Tolls of EPT used in regular use should be clean weekly

Note: **Satisfactory rating – 3 points** **Unsatisfactory - below 3 and 4 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Name: _____ Date: _____

True or False Questions

1. ----------
2. ----------
3. ----------

Operation Sheet 1	Procedure for using try square and checking squares on timber stock

Squares and bevels can become inaccurate over time. Before you use any square or bevel, complete the following procedures check to make sure that it's creating an accurate 90° angle.

Steps 1- Hold the stock firmly against the face/edge of the timber.

Step 2- Move the blade to the required position and draw or score a line along the outside edge of the blade

Step 3- Flip the square over and hold the stock firmly against the timber

Step 4- Check the line. If it's still parallel to the blade, the angle is accurate and the tool is square.

Operation Sheet 2	Procedure for using marking gauge

The Procedure for using marking gauges are listed below

Step 1- Hold the gauge with your index finger pressing firmly against the stock.

Step 2- Lay the beam on the timber and roll the stock forward so that the spur meets the timber at a slight angle.

Step 3- Push the stock away from you, ensuring that it is held firmly against the timber.

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary drawing, tools and materials you are required to perform the following tasks within 8-12 hours.

Task 1: Select the right tools and equipment for the project

Task 2: follow safety procedure for each activity

Task 3: Take measurement according to the drawing

Task 4: Cut the stock to the right dimension

Task5: Plane the stock and make it square

Task6: Check the squarnes of the stock

Table of Answer keys for the self checks provided on each information sheets

UNIT OF COMPETENCY: use carpentry hand and power tools							
LO: 2 LG: 23 Identify and select hand, power and pneumatic tools.							
Self check: 1		Self check:2		Self check:3		Self check:4	
Matching		Multiple choice		True or False		True or False	
1	C	1	B	1	False	1	True
2	F	2	A	2	True	2	False
3	A	3	B	3	False	3	False
4	E	4		4		4	
5	B	5		5		5	

List of Reference Materials

References

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- Construction Health and Safety Manual
- MONITOR%20WORK%20OPERATIONS.pdf%20_%20Competence%20(Human%20Resources)%20_%20Goal.html
- Best practice guide to improving waste management on construction sites
- Interpreting and Applying Equipment Specifications1
  Speaker/Author: Suzanne
- Waste management at the construction site By Joseph Laquatra and Mark Pierce
- Manage workplace operations Trainee Manual William Angliss Institute of TAFE

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