TVET CERTIFICATE III in CARPENTRY

WOOD WORKING MACHINES

CAPWW301 Operate wood working machine

Competence

RTQF Level: 3

Credits: 100

Sector: Construction **Learning hours: 100**

Sub- Sector: Carpentry

Issue date: October, 2020

Purpose statement

This module describes knowledge and skills required to operate wood working machine. It describes the skills, knowledge and attitudes required for the trainee to operate portable power machines and operate heavy duty woodworking machines

Table of Contents

INTRODUCTION TO WOODWORKING MACHINES

- **Definition**

A woodworking machines: is wood machine that is intended to process wood. These machines are usually powered by electric motor and are used extensively in woodworking**.**

- **IMPORTANCE OF WOODWORKING MACHINES**

- To produce the quality and quantity work.
- To reduce the time of work.
- Is used for creating different types of furniture items and finished goods with pieces of wood.
- To gain much money rather than using hand tools.
- Production of different designs on work piece**s.**

- **TYPES OF WOODWORKING MACHINES**

The woodworking machines are divided into two types such as:

- **Portable power machines.**
- **Heavy duty power machines.**

Leaning unit 1 - OPERATE PORTABLE POWER MACHINES

LO1.1: Identify portable power machine

- Content/Topic 1: Types of portable power machines:
  - Portable hand planer

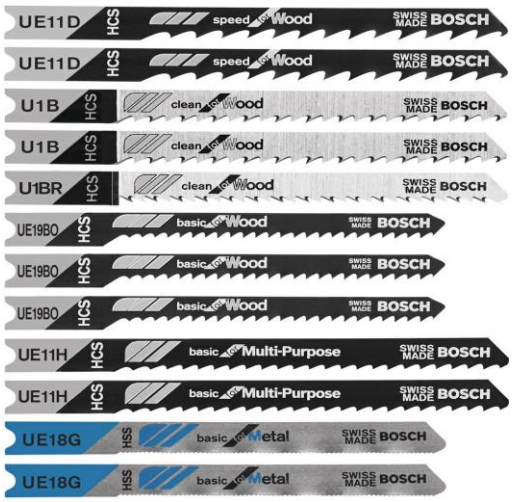
    Structure of portable hand planer.

  - Jig saw machine

A jigsaw is a saw which uses a reciprocating blade to cut irregular curves, such as stenciled designs, in wood, metal, or other materials.

Structure of jig saw

They are different typesjigsaw blade



- **Router machine**

A router is a hand tool or power tool that routs (hollows out) an area in hard material, such as wood or plastic. Routers are mainly used in woodworking.

Structure of router machine

- **Hand sander machine**

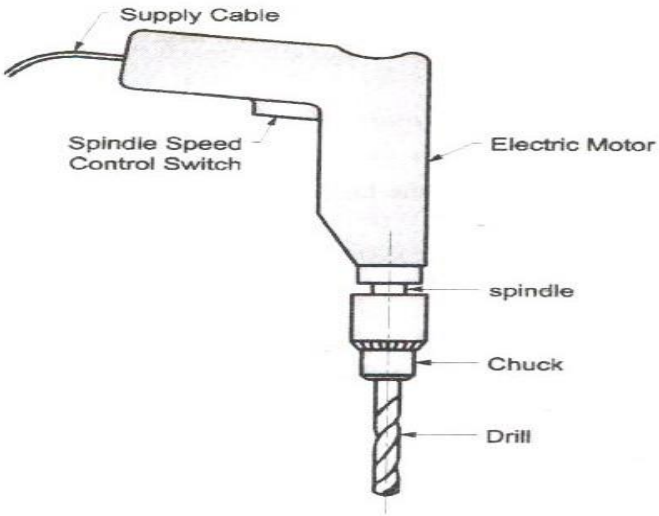
Hand sander portable machine used for smoothing, polishing, or cleaning a surface, as of wood, plastic, or metal. Sanders are also used to roughen surfaces in preparation for finishing.

There are three main types of power sanders: **the disk sander, the belt sander, and the orbital sander.**

Structure of sander

- **Hand drill machine**

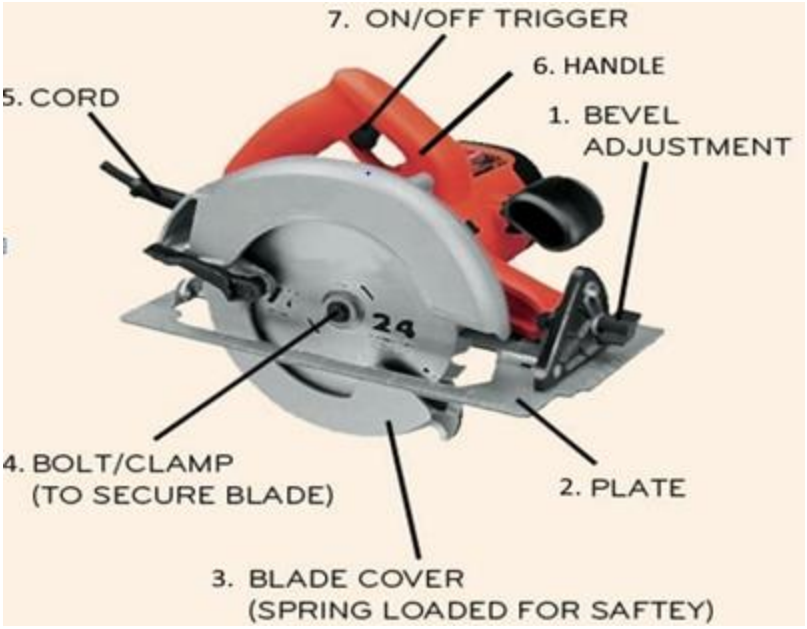
Structure of drill machine



- **Hand circular saw machine**

In woodworking the term circular saw is most commonly used to refer to a hand-held, electric circular saw designed for cutting wood, but may be used for cutting other materials with different blades. Circular saws can be either left or right-handed, depending on the side of the blade where the motor sits.

Structure of circular saw

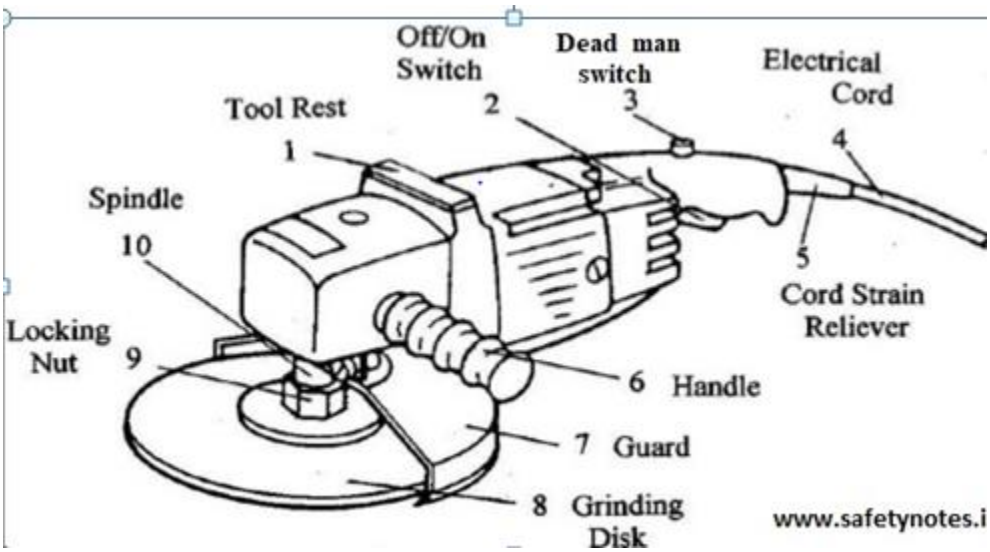


- **Portable nail gun machine or nailer**

  Nailer is a type of tool used to drive nails into wood or some other kind of material. It is usually driven by electromagnetism, compressed air (pneumatic), highly flammable gases such as butane or propane, or, for powder-actuated tools, a small explosive charge. Nail guns have in many ways replaced hammers as tools of choice among builders.

- Portable grinder machine

Figure



- **Portable hand blower**

Figure

It is used for cleaning dust

LO1.2: Explain the operational principles of portable power machines

Content/Topic 1: **Appropriate application of principles of power machines**

Always wear appropriate PPE to protect you from the specific hazards presented by power tools, such as dust exposure and projectiles. PPE such as goggles, dust mask, Gloves, hardhat and safety boots should be worn where appropriate**.**

Appropriate application of techniques and services of portable power machines

Woodworking power machine can be dangerous if not used properly.

- Only use woodworking machines that you have been trained to use properly and safely
- Read the owner's manual carefully.
- Make sure you understand instructions before attempting to use any tool or machine. As questions if you have any doubts about doing the work safely.

Proper use of portable power machines

Power tools are hazardous when improperly used. There are several types of power tools, usually categorized according to the power source (electric, pneumatic, liquid fuel, hydraulic, steam and explosive powder actuated). Employees should be qualified or trained in the use of all power tools used in their work. They should understand the potential hazards associated with the use of power tools, and observe the following general safety precautions to prevent those hazards from occurring:

- Never carry a tool by the cord or hose.
- Never yank the cord or the hose to disconnect it from the receptacle.
- Keep cords and hoses away from heat, oil and sharp edges.
- Disconnect tools when they are not in use, before servicing, and when changing accessories such as blades, bits and cutters.
- All observers should stay a safe distance away from the work area.
- Secure work with clamps or a vise, freeing both hands to operate the tool.

Avoid accidental starting. The worker should not hold a finger on the switch button while carrying a plugged-in tool. Tools which have lock-on controls should be disengaged when power is interrupted so that they do not start up automatically upon restoration of power.

Tools should be maintained with care and kept sharp and clean for best performance. Instructions in the user's manual should be followed for lubrication and changing accessories.

Workers should assure they have good footing and balance when using power tools. Appropriate apparel should be worn, as loose clothing, ties or jewelers can become caught in moving parts.

All portable electric tools that are damaged shall be removed from use and tagged "Do Not Use" to prevent electrical shock.

Protective Guards

Hazardous moving parts of power tools need to be safeguarded. For example, belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains or other reciprocating, rotating or moving parts of equipment must be guarded if such parts are exposed to contact by workers. Where necessary, guards should be provided to protect the operator and others with respect to hazards associated with:

- ✓ The point of operation
- ✓ In-running nip points
- ✓ Rotating and reciprocating parts

Safety guards must never be removed when a tool is being used. For example, portable circular saws must be equipped with guards. An upper guard must cover the entire blade of the saw. A retractable lower guard must cover the teeth of the saw, except when it makes contact with the work material. The lower guard must automatically return to the covering position when the tool is withdrawn from the work.

Workers using portable power machines must be aware of several dangers. The most serious of these is the possibility of electrocution, followed by burns and slight shocks. Under certain conditions, even a small amount of current can result in fibrillation of the heart which may result in death. A shock also may cause a worker to fall off a ladder or other elevated work surfaces

These general safety practices should be followed in using electric tools:

- Portable power machine should be operated within their design limitations.
- Gloves and safety footwear are recommended during use of electric tools.
- When not in use, tools should be stored in a dry place.
- Portable power machine should not be used if wires or connectors are frayed, bent or damaged.
- Portable power machine should not be used in damp or wet locations.
- Work areas should be well lighted.

Workers who use hand and power tools and who are exposed to the hazards of falling, flying, abrasive and splashing objects and materials, or to hazards of harmful dusts, fumes, mists, vapors or gases, must be provided with the appropriate personal equipment necessary to protect them from the hazard. All hazards involved in the use of power tools can be prevented by workers following five basic safety rules:

- ❖ Keep all machines in good condition with regular maintenance.
- ❖ Use the right portable power machine for the job.
- ❖ Examine each machine or damage before use.
- ❖ Operate power portable machines according to the manufacturer's instructions.
- ❖ Select and use appropriate protective equipment.

- What safely procedures should you follow when using woodworking machines?

- What should you avoid when working with woodworking machines?

LO1.3: Operate portable power machine

Content/Topic 1: **Operation of portable machines**

- ➢ Portable hand planer

Main operations of portable hand planer

- Planning RFS,RFE,ORFS,ORFE
- Rebeting
- Chamfering
- Beveling

- ➢ Portable Jig saw machine

Main jig saw operations

- Cross cutting
- Ripping
- Cutting to patterns

- ➢ Portable router machine

Main router machine operations:

- Mouldings of various types
- Mortising
- Grooving
- Rebating
- Dado housing
- Single dado housing

- ➢ Portable sander machine

Main operations of sander machine

- Sanding edges
- Sanding surfaces
- Sanding hollow surfaces
- Sanding round

- Portable drill machine

  Main operations of drill machine

  - Drill various sizes of holes
  - Use it as a screw driver: screwing and unscrewing.

- Portable circular saw machine

  Main operations of circular saw

  - Ripping
  - Cross cutting
  - Tenoning
  - Grooving
  - Rebeting
  - Housing
  - Dovetail housing
  - Open mortising, Tenon shoulder cutting, Tenon shoulder scribing

- Portable grinder machine

  It is used for:

  - Cutting and grinding metal

- Sanding timber by changing the metal cutter and grinder with a sanding timber and a sanding paper.

When using a powered grinder:

- Always use eye or face protection.
- Turnoff the power when not in use.
- Never clamp a hand held grinder in a vise.

- **Portable blower machine**

It is used for cleaning dust.

Leaning unit 2 -Operate embroidery equipment and tools

LO2.1: Identify heavy duty machine

Content/Topic 1 **Identification of heavy duty woodworking machines**

At that time people were doing simple furniture by hand and use very local hand tools, they produced simple furniture because of lacking modern facilities.

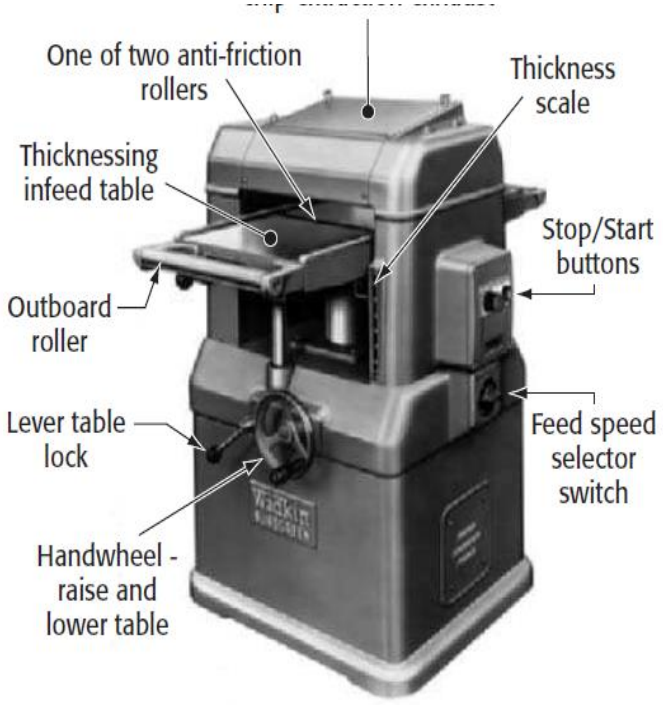
Modern machines came from developing the local hand tools to modern tools by improving the machine to be driven by electricity instead of using manual forces.

Basic static woodworking machines:

Types of heavy machines:

- The Jointer/surface planer machine

- The thicknesser machine

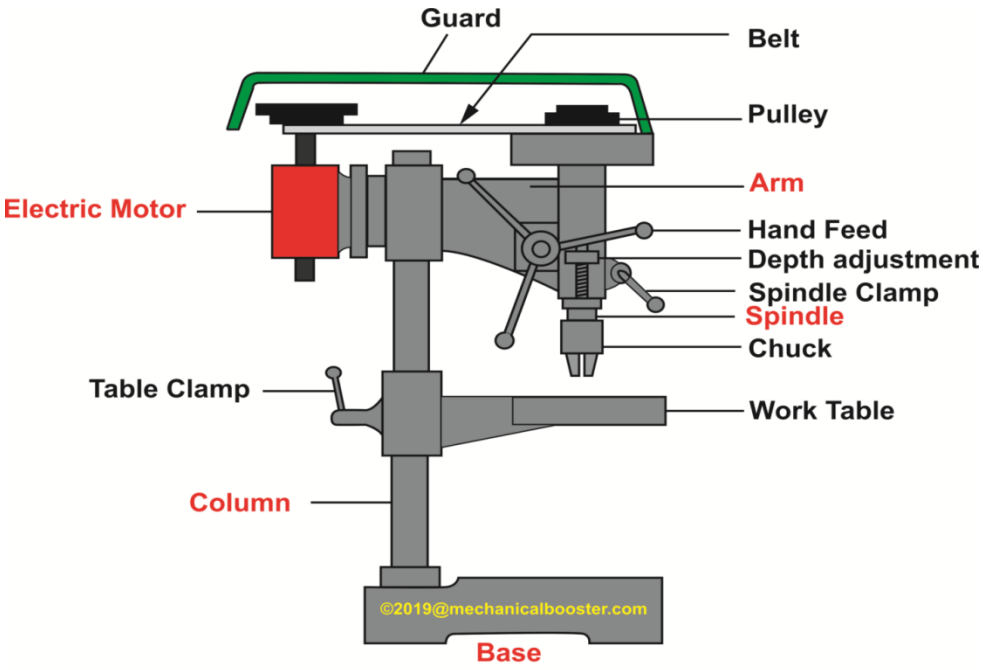


- Radial arm saw

- Band saw machine

- Moulding machine

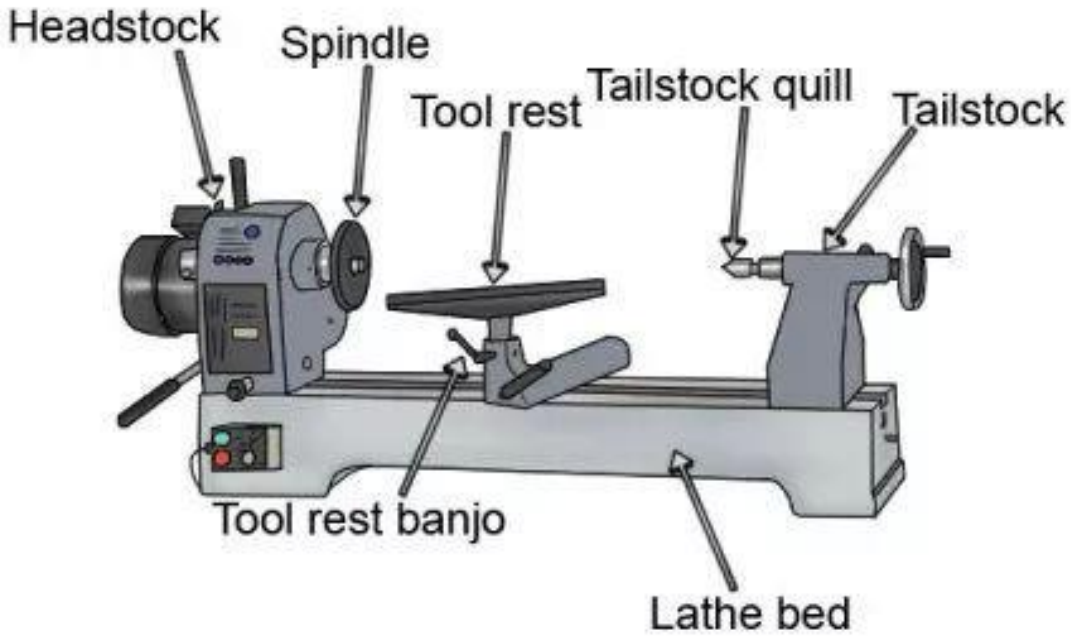
- Boring machines /drilling machines



Main Parts of Drilling Machine

- sanding machine

- The wood lathe/ turning machine



- Sander machines
- Resharpening machine

LO2.3: Apply safety on heavy duty machines

Content/Topic 1 **safety precautions of heavy duty woodworking machines**

Woodworking machines, There are more accidents at woodworking machines than at any other type of machine. Woodworking machines often have high-speed cutters which cannot be totally enclosed. Most accidents happen at circular saws, planning machines, vertical spindle-moulding machines and band saws. The simple steps given below will help to prevent accidents at woodworking machines.

•Make sure that employees are fully trained before they are allowed to work unsupervised at any woodworking machine.

•Check that guards and other safety devices are provided and used.

•Use a power-feed tool to feed wood into the machine whenever possible. If feeding the wood into the machine by hand, use well-designed push-sticks or jigs.

•Make sure that machine controls are labeled, conveniently positioned and well maintained.

•Switch off machines when they are not being used.

•Isolate machines from the electrical supply before changing cutters or carrying out maintenance work.

•To prevent slips and trips, keep the working area around machines clear of obstructions and floors free from loose materials such as chippings or waste wood. Keeping the workshop clean will also reduce the risk of fi re or explosion.

•Make sure there is good lighting and heating.

•Provide and maintain a suitable system for collecting wood dust.

•Encourage employees to report any faults with machines or processes to their supervisor.

Before use properly a heavy duty woodworking machines, you must know the following measures:

- Everyone must know where the safety switches are allocated in the workshop.

-Don’t operate a machine which you don’t know, and understand how it functions.

-Don’t switch on the machine without permission from the instructor.

-Make sure that they are of the machine is clean from dust, waste pieces, etc…

-Don’t put on loose clothes when working on the machine.

-put on safety shoes.

-Don’t put on hanging ties unless well fixed and proper dressed.

-Make sure you don’t keep long nails because you may stuck somewhere and get injured.

-Never make jokes with someone working on a machine.

-Never do setting when the machine is revolving.

-Make sure that before switching on the machine the required safety devices are on the machine table.

-Before planning the timber it must be inspected (free from sand, nails, loose knots, danger loose shakes, etc…)

-Clean your timber with wire brush to remove stuck stones, dust etc…

-Enough ventilation is required in every workshop.

-Workshop floor must be rough not fine because of avoiding slippery.

-Never use blunt tools.

-Make sure to use a proper tool for a proper work or operation.

-Every workshop must have fire extinguisher.

-Everyone in the woodworking machines workshop must make the use of individual machine safety one precautions. You must use your own common sense with the aid of safety measures.

Appropriate application working principles of heavy duty machines

Woodworking tools can be dangerous if not used properly.

What should you do before using woodworking machines?

• Only use woodworking machines that you have been trained to use properly and safely.

• Read the owner's manual carefully.

• Make sure you understand instructions before attempting to use any tool or machine. Ask questions if you have any doubts about doing the work safely.

What safety procedures should you follow when using woodworking machines?

• Always wear safety glasses or goggles

•Wear a dust mask.

• Wear hearing protection that is suitable for the level and frequency of the noise you are exposed to in the woodworking area. If you have trouble hearing someone speak from three feet away, the noise level from the machine is too high. Damage to hearing may occur.

• Use gloves to protect hands from splinters when handling wood but do not wear them near rotating blades and other machinery parts where the gloves can catch.

• Make sure all guards are in position, are in good working condition, and guard the machine adequately before operating any equipment or machine. Check and adjust all other safety devices.

• Make sure the equipment is properly grounded before use.

• Check that keys and adjusting wrenches are removed from the machine before turning on the power.

• Inspect stock for nails or other materials before cutting, planing, routing or carrying out similar activities.

• Make sure that all machines have start and stop buttons within easy and convenient reach of an operator. Start buttons should be protected so that accidental contact will not start the machine.

What should you avoid when working with woodworking machines?

• Do not wear loose clothing, work gloves, neckties, rings, bracelets or other jewelry that can become entangled with moving parts.

• Avoid awkward operations and hand positions where a sudden slip could cause your hand to move into the cutting tool or blade.

• Do not remove sawdust or cuttings from the cutting head while a machine is running. Use a stick or brush when the machine has stopped moving to remove the sawdust or cutting.

They are the most causes of accident while use the woodworking machines such as:

- Lack of knowledge
- Laziness in fixing properly
- Bad maintenance of machine

Machine operations

There are three major processes involved in manufacturing of wooden working machines as follows:

-Cutting out and planning to size.

-Jointing and shaping

-Finishing

LO2.3: Operate heavy duty machine

Content/Topic 1 **Operation of heavy duty woodworking machines**

- ❖ Circular saw machine

A circular saw is a power-saw using a toothed or abrasive disc or blade to cut different materials using a rotary motion spinning around an arbor. ... A circular saw is a tool for cutting many materials such as wood, masonry, plastic, or metal and may be hand-held or mounted to a machine.

THE CUTTING HEADS

The majority cutting units of woodworking machines in joinery classified as follows:

a. Saws

b.Cutter blocks

The saws are classified as follows:

i) Circular saws

ii)Band saw blades

The Cutter blocks are classified as follows:

i) Square cutter blocks

ii) Circular cutter block

iii) Slotted cutter blocks or solid profile blocks

Structure of circular saw

Circular sawing machines are used for sawing straight-line oblong, cross and angular cuts in solid wood and sheet material. Solid woods are seamed and sheet material cut down to width through oblong cuts. Solid woods and sheet material are cut to length through cross and angular cuts.The circular saw blades are divided into two main parts:

a) Ripping saws:are saws which are used to cut the wood following the direction of the wood fibers.

Ripping saws have got bigger teeth at the distance of 25 mm or 1 inch

b) Cross cut saws:are special blades which are circular narrower at the center and wider to the outer edges.

After resharpening the saw blade, there is no need of saw setting because the saw blade is wider at the cutting edge, it gives enough clearance to the saw kerfs.

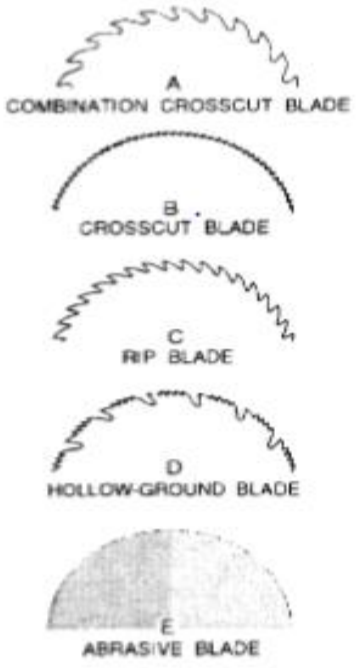
The setting has been done direct from the manufacturer.

The setting is called **SWAGE SET.**

Circular saws can use many different types of cutting blades

- **COMBINATION CROSSCUT AND RIP BLADES**: Combination blades are all-purpose blades for cutting thick and thin hardwoods and softwoods, both with or across the grain. They can also be used to cut plywood and hardboard.

- **CROSSCUT BLADES**: Crosscut blades have fine teeth that cut smoothly across the grain of both hardwood and softwood. These blades can be used for plywood, veneers, and hardboard
- **RIP BLADES**: Rip blades have bigger teeth than combination blades, and should be used only to cut with the grain. A rip fence or guide will help you make an accurate cut with this type of blade
- **HOLLOW-GROUND BLADES**: Hollow ground blades have no set. They make the smoothest cuts on thick or thin stock. Wood cut with these blades requires little or no sanding.



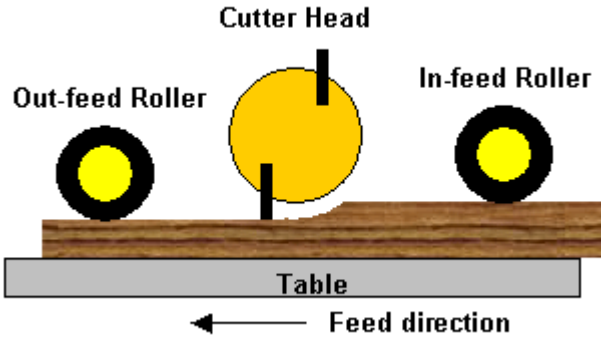
- Surface or jointer planer machine, Thickness planer machine

A thickness planer is a woodworking to trim boards to a consistent thickness throughout their length and flat on both surfaces.

A thickness planer consists of three elements: a cutter head which contains the cutting knives; a set of rollers which draw the board through the machine; and a table which is adjustable relative to the cutter head to control the resultant thickness of the board. Some portable thickness planers differ slightly in that the table is fixed and the cutter head/feed roller assembly is adjusted.

In operation, the table is set to the desired height and then the machine is switched on. The board is fed into the machine until it makes contact with the in-feed roller which grips the board and draws it into the machine and past the rotating cutter head. The knives remove material on the way through and the out-feed roller pulls the board through and ejects it from the machine at the end of the pass.

Structure shows the direction of timber on the surface planer



The jointer derives its name from its primary function of producing flat edges on boards prior to joining them edge-to-edge to produce wider boards. The use of this term probably arises from the name of a type of hand plane, the jointer plane, which is also used primarily for this purpose.

- **Sanding machine**

A sander is a power tool used to smooth surfaces by abrasion with sandpaper. Sanders have a means to attach the sandpaper and a mechanism to move it rapidly contained within a housing with means to hand-hold it or fix it to a workbench.

- **Drilling machine**

The Drill Press machine has a movable carriage that allows the user to drill holes in the center of large pieces . It also has a tilting carriage feature that gives it the ability to drill holes at an infinite number of angles.

- **Turning machine/ wood lathe machine**

The Lathe is used for making things round in cross-section. Material is mounted in the chuck and tools are used to "cut" the shape as the material spins. Shaped spindles, bowls and other semi-circular objects can be turned on the lathe.

- **Procedure used for the wood lather**
  - Prepare work
  - Fix material to wood lathe
  - Cut by using circular bite
  - Mark by using cut off bite
  - Trim by using flat bite
  - Make a loop
  - Finishing

❖ **Spindle moulding machine**

In machine tools, a spindle is a rotating axis of the machine, which often has a shaft at its heart. A machine tool may have several spindles, such as the headstock and tailstock spindles on a bench lathe. The main spindle is usually the biggest one.

One of the most versatile machines in woodworking, it can be used for mouldings, rebates and curved work. However, it can be dangerous if not used correctly, because of the risk of contact with the tool, and ejection of the tool part or work piece.

When operating a moulding, observe the following safety precautions:

- Like the jointer and surface, the shaper cuts toward the infeed side of the spindle, this is against the rotation of the spindle. Therefore, stock should be placed with the grain running toward the infeed side.
- Make sure the cutters are sharp and well secured.
- If curved or irregularly shaped edges are to be shaped, place the stock in position and make sure the collar will rub against the part of the edge, which should not be removed.
- Whenever the straight fence cannot be always use a starting pin in the table top.
- Never make extremely deep cuts.
- Make sure shaper cutter rotate toward the work.
- Make sure the shaper cutters rotate toward the work.
- Whenever possible, always use a guard, pressure bar, hold-down, or holding jig.
- If possible, place the cutter on the shaper spindle so that the cutting will be done on the lower side of the stock.
- Do not attempt to shape small pieces of wood.

- Check all adjustments before turning on the power.

❖ **Band saw machine**

A bandsaw (also written band saw) is a power saw with a long, sharp blade consisting of a continuous band of toothed metal stretched between two or more wheels to cut material. They are used principally in woodworking, metalworking, and lumbering, but may cut a variety of materials.

The band saw machine cuts by drawing a continuous metal band across the work piece. The band saw blade is supported and driven by a drive wheel and an idler wheel. Because each tooth is a precision cutting tool, accuracy can be held to close tolerances. This eliminates or minimizes many secondary machining operations.

How to Determine Band saw Blade Length

- Make a mark on the blade.
- Place a piece of tape on the floor and make a mark to determine your starting point.
- Roll the blade in a straight line until the mark you previously made comes back and hits the floor.
- Make a second mark on a piece of tape.
- Measure the distance between your two marks on the floor

Observe the following safety precautions when operating a band saw:

- Keep your fingers away from the moving blade.
- Keep the table clear of stock and scraps so your work will not catch as you push it along.
- Keep the upper guide just above the work, not excessively high.
- Don’t use cracked blades. If a blade develops a click as it passes through the work, the operator should shut off the power because the click is a danger signal that the blade is cracked and may be ready to break. After the saw blade has stopped moving, it should be replaced with one in proper condition.
- If the saw blade breaks, the operator should shut off the power immediately and not attempt to remove any part of the saw blade until the machine is completely stopped.
- If the work binds or pinches on the blade, the operator should never attempt to back the work away from the blade while the saw is in motion since this may break the blade. The operator should always see that the blade is working freely through the cut.

References:

- https/www.jettools.com
- https/www.pinterest.com
- https://en.wikipedia.org/woodworking machine.
- carpentry and joinery(third edition1),Brian Porter